SECURITY INFORMATION

[redacted]

Copy
RM L53J21

[redacted]

NACA RM L53J21

7497

NACA

RESEARCH MEMORANDUM

WIND-TUNNEL INVESTIGATION AT TRANSONIC SPEEDS OF A SPOILER-SLOT-DEFLECTOR COMBINATION ON AN UNSWEPT NACA 65A006 WING

By Raymond D. Vogler

Langley Aeronautical Laboratory
Langley Field, Va.

CLASSIFIED DOCUMENT

[redacted]

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
WASHINGTON
December 8, 1953

[redacted]

[redacted]

 [redacted]

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUM

WIND-TUNNEL INVESTIGATION AT TRANSONIC SPEEDS OF A SPOILER-SLOT-DEFLECTOR COMBINATION ON AN UNSWEPT NACA 65A006 WING

By Raymond D. Vogler

SUMMARY

An investigation was made in the Langley high-speed 7- by 10-foot tunnel to determine the effectiveness of a spoiler-slot-deflector combination in producing rolling moments in the transonic speed range at angles of attack as high as 24°. By use of the transonic bump a Mach number range from 0.62 to 1.20 was obtained. The wing had an aspect ratio of 4, a taper ratio of 0.6, an unswept quarter-chord line, and NACA 65A006 airfoil sections. Forces and moments on the semispan model were obtained with a 57-percent-semispan outboard spoiler-slot-deflector combination located between the 55- and 70-percent-chord lines. For comparison, data were also obtained with spoiler vented and unvented and without a deflector.

As was previously found at lower speeds, a spoiler-slot-deflector combination was more effective at transonic speeds than a spoiler alone in producing rolling moments over a greater angle-of-attack range. At positive angles of attack up to about 12° the spoiler and the spoiler-slot-deflector combination suffer some loss in effectiveness in and above the transonic speed range, but at high angles of attack both configurations show increasing effectiveness with increasing Mach number in the region near $M = 1.0$. The rolling effectiveness of the spoiler-slot-deflector combination is approximately proportional to the projection for the range investigated.

INTRODUCTION

The spoiler used as a lateral-control device has been the subject of considerable investigation at low and high speeds, and on both swept and unswept wings (refs. 1 to 3). Recent investigations of spoilers used as lateral-control devices have shown that on thin wings with small

[redacted]

[redacted]

leading-edge radii the unvented spoiler loses effectiveness rapidly as the angle of attack is increased above 8° (refs. 2 and 3). However, investigations at low and high subsonic speeds as reported in references 3 to 5 have shown that this loss in effectiveness at the higher angles of attack could be substantially reduced by using a slot in the wing behind the spoiler that would allow the air to flow through the wing from the lower to the upper surface when the spoiler was deflected.

The purpose of this investigation was to extend through the transonic speed range previous low and high subsonic speed investigations of spoiler-slot-deflector devices for lateral control. The investigation was made in the Langley high-speed 7- by 10-foot tunnel using the transonic bump to obtain Mach numbers from 0.62 to 1.20. The angle-of-attack range was -4° to 24°. Rolling, yawing, and pitching moments, and lift and drag were obtained with spoiler alone, spoiler-gap lip combination, and spoiler-slot-deflector combination.

SYMBOLS AND COEFFICIENTS

The forces and moments measured on the model are presented about an orthogonal system of axes whose origin coincides with the point of intersection of the root chord line and the quarter-chord line. The longitudinal axis is parallel to the free air stream and the lateral axis coincides with the quarter-chord line.

C_L lift coefficient, $\frac{\text{Twice semispan lift}}{qS}$

ΔC_L increment of lift coefficient produced by the control

C_D drag coefficient, $\frac{\text{Twice semispan drag}}{qS}$

ΔC_D increment of drag coefficient produced by the control

C_m pitching-moment coefficient, $\frac{\text{Twice semispan pitching moment}}{qS\bar{c}}$

ΔC_m increment of pitching-moment coefficient produced by the control

C_l rolling-moment coefficient produced by the control, $\frac{\text{Rolling moment}}{qSb}$

C_n yawing-moment coefficient produced by the control, $\frac{\text{Yawing moment}}{qSb}$

q dynamic pressure, $\frac{\rho V^2}{2}$, lb/sq ft

ρ mass density of air, slugs/cu ft

V free-stream air velocity, fps

S twice wing area of semispan model, 0.125 sq ft

b twice wing span of semispan model, 0.707 ft

c local chord, ft

$\bar{c}$ mean aerodynamic chord of wing, 0.1805 ft

M Mach number

R Reynolds number of wing based on $\bar{c}$

α angle of attack, deg

δ_s spoiler projection, negative when projected from upper surface of wing, percent chord

δ_d deflector projection, positive when projected from lower surface of wing, percent chord

MODEL AND APPARATUS

A drawing of the model and pertinent information are given in figure 1. The solid steel wing had NACA 65A006 airfoil sections parallel to the free air stream, an unswept quarter-chord line, an aspect ratio of 4, and a taper ratio of 0.6. The lateral-control devices investigated included a spoiler, a spoiler-gap-lip combination, and a spoiler-slot-deflector combination (fig. 1). The spoilers and deflectors were made of 0.02-inch-thick steel plates. The leading edge of the spoiler was inlaid flush with the wing surface. Spoiler projections were obtained by raising the rear edge of the plates and bending them along the 55-percent-chord line of the wing. Deflector projections were obtained by bending the plates along the 70-percent-chord line. For the spoiler-slot-deflector configurations, a slot was cut through the wing between the 55- and 70-percent-chord lines, except for two chordwise ribs which

were left for stiffness (fig. 1). The lip was made of a thin piece of metal extending from the rear of the slot forward along the original contour of the wing lower surface. In the spoiler-gap-lip configuration part of the 0.15c slot was filled with a fairing leaving a gap of 0.025c between the fairing and the lip (fig. 1). The lip and the deflectors had sharp leading edges. Each of the control configurations had a span of 0.57b/2 and extended from 0.40b/2 to 0.97b/2.

The model was mounted on an electrical strain-gage balance enclosed within the bump. The wing was attached to the balance mount through a wing-profile cutout in the turntable in the surface of the bump. Air flow between the wing root and the cutout was restricted by a sponge rubber seal attached to the wing butt within the balance chamber. The forces and moments were measured simultaneously with calibrated recording potentiometers.

TESTS AND CORRECTIONS

The model was tested in the flow field of a transonic bump mounted on the floor of the Langley high-speed 7- by 10-foot tunnel. The Mach number range was from 0.62 to 1.20 and the angle-of-attack range from -4° to 24°. Investigations were made of the spoiler alone, spoiler-gap-lip, and spoiler-slot-deflector configurations with the spoiler projected various amounts up to 10 percent of the local wing chord. On the spoiler-slot-deflector combination the ratio of spoiler projection to deflector projection was 4 to 3.

The variation of mean test Reynolds number, based on the mean aerodynamic chord, with Mach number is given in figure 2.

No corrections to the data have been applied. The usual wind-tunnel blockage and jet-boundary corrections are considered negligible on account of the small size of the model. Reflection-plane corrections to the rolling moments were dispensed with since this investigation was concerned primarily with the effects of angle of attack and Mach number on the relative effectiveness of spoiler-type controls having the same span and the same spanwise location. From experimental and theoretical considerations, it is believed that the magnitude of the rolling-moment data as presented is approximately 15 percent too large at the lowest Mach number but at a Mach number of 1.0 or above is approximately correct.

RESULTS AND DISCUSSION

Presentation of Data

The lift, drag, and pitching-moment coefficients of the plain wing are presented in figure 3, and the increments of lift, drag, and pitching-moment coefficients produced by various controls are shown in tables I to III, as a matter of general interest, along with the yawing- and rolling-moment coefficients. Since the investigation was concerned primarily with lateral control, only the rolling-moment data of tables I to III have been plotted to show the effect of important parameters on the rolling effectiveness of the controls.

Lateral Control Characteristics

An inspection of the tabular values of rolling- and yawing-moment coefficients of the spoiler alone shows the values to have the same algebraic sign in most cases which means that the yawing-moment coefficients are generally favorable or small if unfavorable. However, with the spoiler-slot-deflector combination there are some adverse yawing moments at high angles of attack.

The variation of rolling-moment coefficient with angle of attack for various projections of the controls for the three configurations investigated is given in figure 4. At subsonic speeds the effectiveness of spoiler alone decreased rapidly as the angles of attack were increased above 8° resulting in near zero rolling-moment coefficients at angles of attack from 16° to 20°. The variation of effectiveness with angle of attack is similar to but less abrupt than that shown for the swept wings of references 2 and 5. At supersonic speeds the decrease in spoiler effectiveness with increase in angle of attack was more gradual than at subsonic speeds. The addition of a 0.025c gap in the wing and a sharp lip behind the gap along the lower surface of the wing improved the effectiveness of the spoilers at the higher angles of attack at all Mach numbers. Considerably more improvement throughout the angle-of-attack range and Mach range was obtained by increasing the gap to 0.15c and adding a deflector behind the slot on the lower surface of the wing to direct more air through the slot. A ratio of deflector projection to spoiler projection of 3 to 4, previously found effective throughout the angle-of-attack range (ref. 5), was used in this investigation. The improvement in rolling effectiveness obtained with the slot and deflector is typical of the results obtained in previous investigations of swept wings at subsonic speeds (refs. 3 and 5). At low supersonic Mach numbers the improvement results in rolling-moment coefficients that were fairly constant throughout the angle-of-attack range.

Figure 5 shows the effect of Mach number on the rolling-moment coefficients of the spoiler alone and the spoiler-slot-deflector combination. Both configurations show decreasing rolling-moment coefficients in and above the transonic speed range at positive angles of attack up to about 12°, but both configurations show increasing values at the higher angles of attack in the region near $M = 1.0$.

The variation of rolling-moment coefficient with projection is given in figure 6 for the spoiler alone and for the spoiler-slot-deflector combination at 0° and 16° angles of attack. The increased effectiveness of the spoiler-slot-deflector combination through the projection range at low and high angles of attack is indicated. The effectiveness of the controls is approximately proportional to control projections, although the spoiler alone has lower effectiveness in the projection range near one percent.

CONCLUSIONS

A wind-tunnel investigation was made to determine the effectiveness of a spoiler-slot-deflector combination in producing rolling moments in the transonic speed range through an angle-of-attack range from -4° to 24°. As a result of the investigation the following conclusions are made:

1. As was previously found at low and high subsonic speeds, a spoiler-slot-deflector combination is more effective in producing rolling moments over a greater angle-of-attack range than an unvented spoiler alone at Mach numbers through the transonic range up to 1.20.

2. At positive angles of attack up to about 12° the spoiler and the spoiler-slot-deflector combination suffer some loss in effectiveness in and above the transonic speed range, but at high angles of attack both configurations show increasing effectiveness with increasing Mach number in the region near $M = 1.0$.

3. At Mach numbers from 0.62 to 1.20 and angles of attack from -4° to 24°, the rolling effectiveness of the spoiler-slot-deflector combination is approximately proportional to the projection.

Langley Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., October 7, 1953.

REFERENCES

1. Wenzinger, Carl J., and Rogallo, Francis M.: Wind-Tunnel Investigation of Spoiler, Deflector, and Slot Lateral-Control Devices on Wings With Full-Span Split and Slotted Flaps. NACA Rep. 706, 1941.

2. Vogler, Raymond D.: Wind-Tunnel Investigation at High Subsonic Speeds of Spoilers of Large Projection on an NACA 65A006 Wing With Quarter-Chord Line Swept Back 32.6. NACA RM L51L10, 1952.

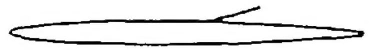
3. Watson, James W.: Low-Speed Lateral-Control Investigation of a Flap-Type Spoiler Aileron With and Without a Deflector and Slot on a 6-Percent-Thick, Tapered 45° Sweepback Wing of Aspect Ratio 4. NACA RM L52G10, 1952.

4. West, F. E., Jr., Solomon, William, and Brummal, Edward M.: Investigation of Spoiler Aileron With and Without a Gap Behind the Spoiler on a 45° Sweptback Wing-Fuselage Combination at Mach Numbers From 0.60 to 1.03. NACA RM L53G07a, 1953.

5. Vogler, Raymond D.: Wind-Tunnel Investigation at High Subsonic Speeds of a Spoiler-Slot-Deflector Combination on an NACA 65A006 Wing With Quarter-Chord Line Swept Back 32.6°. NACA RM L53D17, 1953.

CONFIDENTIAL

Table I.— Spoiler



$\delta_s = -.01c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	-4.0	.0112	-.0078	-.0091	.0046	-.0005
.62	.0	-.0073	.0057	.0037	-.0000	-.0006
.62	4.0	.0073	.0047	-.0037	-.0001	.0001
.62	8.0	.0256	.0101	.0018	.0006	-.0003
.62	12.0	.0190	.0037	.0095	-.0005	-.0001
.62	16.0	.0392	.0089	.0116	.0008	.0005
.84	-4.0	-.0127	-.0042	.0039	.0020	.0001
.84	.0	-.0062	.0059	.0076	.0004	-.0010
.84	4.0	.0090	.0083	.0012	-.0002	.0002
.84	8.0	.0018	.0106	-.0049	-.0017	.0007
.84	12.0	.0032	.0053	.0004	-.0004	.0012
.84	16.0	-.0027	-.0004	-.0005	-.0013	.0007
.95	-4.0	-.0850	.0029	.0131	-.0025	-.0023
.96	.0	-.0308	.0046	.0131	-.0018	-.0012
.96	4.0	.0022	-.0018	.0033	-.0002	-.0013
.96	8.0	.0044	.0046	.0011	.0003	-.0010
.96	12.0	.0165	.0114	-.0273	.0008	-.0015
.96	16.0	-.0055	.0018	-.0076	.0005	-.0008
.96	20.0	-.0000	-.0087	.0043	.0018	-.0005
1.01	-4.0	-.0146	.0059	.0249	-.0028	-.0022
1.01	.0	-.0000	-.0005	-.0031	-.0002	-.0025
1.01	4.0	.0002	-.0027	-.0062	-.0000	-.0036
1.01	8.0	.0018	-.0021	-.0156	-.0000	-.0006
1.01	12.0	-.0067	-.0058	-.0115	.0001	-.0007
1.01	16.0	-.0222	-.0122	-.0126	-.0005	-.0003
1.01	20.0	-.0033	-.0084	-.0167	.0001	-.0010
1.01	24.0	-.0303	-.0257	-.0054	-.0010	-.0006
1.07	-4.0	-.0006	-.0046	-.0029	-.0001	-.0015
1.07	.0	-.0030	-.0031	-.0020	-.0010	-.0008
1.07	4.0	.0065	-.0035	-.0060	-.0000	-.0008
1.07	8.0	-.0050	-.0055	-.0090	-.0000	-.0009
1.07	12.0	-.0037	-.0084	-.0111	.0003	-.0011
1.07	16.0	-.0153	-.0098	-.0102	-.0009	-.0009
1.07	20.0	-.0318	-.0147	-.0103	-.0014	-.0001
1.07	24.0	-.0176	-.0146	-.0073	.0007	-.0009
1.12	-4.0	.0014	-.0059	-.0057	-.0000	-.0003
1.12	.0	-.0077	-.0009	-.0076	-.0005	-.0005
1.12	4.0	.0033	-.0049	-.0046	-.0003	-.0010
1.12	8.0	-.0010	-.0073	-.0059	-.0005	-.0005
1.12	12.0	.0042	-.0022	-.0078	.0004	-.0005
1.12	16.0	-.0069	-.0099	-.0051	-.0009	-.0003
1.12	20.0	-.0172	-.0102	-.0052	-.0012	-.0001
1.12	24.0	-.0314	-.0200	-.0014	-.0010	-.0001
1.20	-4.0	-.0062	-.0065	-.0008	.0001	-.0004
1.20	.0	.0009	-.0032	-.0055	-.0004	-.0006
1.20	4.0	-.0011	-.0047	-.0091	.0001	-.0008
1.20	8.0	.0014	-.0040	-.0057	-.0001	-.0003
1.20	12.0	-.0063	-.0076	-.0067	-.0004	-.0000
1.20	16.0	-.0150	-.0102	-.0016	-.0008	.0001
1.20	20.0	-.0190	-.0142	-.0020	-.0011	.0005

$\delta_s = -.05c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	-4.0	-.0909	.0143	-.0183	-.0056	-.0016
.62	.0	-.0646	.0281	.0055	-.0084	-.0084
.62	4.0	-.1097	.0124	-.0110	-.0128	-.0015
.62	8.0	-.0464	.0064	-.0110	-.0066	-.0015
.62	12.0	.0137	.0082	-.0071	-.0032	-.0011
.62	16.0	.0505	.0067	-.0087	.0004	-.0005
.84	-4.0	-.1460	.0855	-.0201	-.0130	-.0042
.84	.0	-.1535	.0870	.0213	-.0146	-.0032
.84	4.0	-.1762	.0124	.0087	-.0161	-.0024
.84	8.0	-.0855	.0037	-.0049	-.0122	-.0008
.84	12.0	-.0081	.0006	-.0060	-.0039	-.0010
.84	16.0	.0085	-.0056	-.0050	-.0018	-.0010
.95	-4.0	-.2051	.0415	.0491	-.0170	-.0065
.95	.0	-.1815	.0339	.0393	-.0171	-.0040
.95	4.0	-.0743	.0173	.0066	-.0118	-.0026
.95	8.0	-.0520	.0042	.0087	-.0079	-.0012
.95	12.0	-.0487	.0032	-.0035	-.0061	-.0010
.95	16.0	-.0359	-.0092	.0031	-.0046	-.0005
.95	20.0	-.0250	-.0166	.0005	-.0022	.0005
1.01	-4.0	-.1050	.0448	.0272	-.0112	-.0067
1.01	.0	-.1076	.0857	.0135	-.0101	-.0060
1.01	4.0	-.0606	.0128	.0009	-.0082	-.0055
1.01	8.0	-.0472	.0037	.0008	-.0066	-.0018
1.01	12.0	-.0461	-.0048	.0026	-.0058	-.0009
1.01	16.0	-.0436	-.0131	-.0017	-.0055	-.0004
1.01	20.0	-.0141	-.0013	-.0158	-.0025	-.0003
1.01	24.0	-.0172	-.0190	-.0070	-.0030	.0003
1.07	-4.0	-.0807	.0313	-.0018	-.0020	-.0057
1.07	.0	-.0936	.0219	.0168	-.0095	-.0038
1.07	4.0	-.0557	.0117	.0068	-.0068	-.0027
1.07	8.0	-.0449	.0025	.0017	-.0060	-.0022
1.07	12.0	-.0431	-.0081	.0034	-.0057	-.0017
1.07	16.0	-.0435	-.0134	-.0006	-.0052	-.0014
1.07	20.0	-.0498	-.0269	-.0047	-.0060	-.0004
1.07	24.0	-.0107	-.0105	-.0107	-.0088	-.0015
1.12	-4.0	-.0859	.0314	-.0087	-.0085	-.0043
1.12	.0	-.0894	.0217	.0134	-.0082	-.0034
1.12	4.0	-.0479	.0093	.0123	-.0062	-.0029
1.12	8.0	-.0409	.0010	.0082	-.0057	-.0020
1.12	12.0	-.0370	-.0017	.0061	-.0048	-.0013
1.12	16.0	-.0391	-.0106	.0068	-.0053	-.0005
1.12	20.0	-.0422	-.0151	.0085	-.0045	-.0005
1.12	24.0	.0084	-.0226	.0065	-.0037	.0001
1.20	-4.0	-.0893	.0300	.0093	-.0087	-.0047
1.20	.0	-.0633	.0198	.0091	-.0053	-.0034
1.20	4.0	-.0456	.0113	.0026	-.0048	-.0026
1.20	8.0	-.0372	.0072	.0042	-.0051	-.0009
1.20	12.0	-.0454	-.0040	.0067	-.0046	-.0005
1.20	16.0	-.0464	-.0185	.0120	-.0046	.0002
1.20	20.0	-.0438	-.0202	.0118	-.0044	.0004

CONFIDENTIAL

Table I.— Concluded

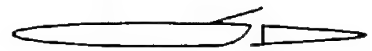
$\delta_s = -.075c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	-4.0	-.1450	.0356	-.0092	-.0154	-.0057
.62	.0	-.1715	.0366	.0110	-.0166	-.0048
.62	4.0	-.1869	.0250	-.0055	-.0205	-.0030
.62	8.0	-.1378	.0105	-.0000	-.0169	-.0011
.62	12.0	-.0287	-.0004	-.0017	-.0070	-.0005
.62	16.0	.0481	.0081	-.0034	.0001	-.0000
.84	-4.0	-.2407	.0499	.0313	-.0281	-.0077
.84	.0	-.2557	.0434	.0363	-.0237	-.0061
.84	4.0	-.2554	.0262	.0174	-.0263	-.0033
.84	8.0	-.1871	.0063	.0076	-.0215	-.0006
.84	12.0	-.0620	-.0039	.0015	-.0099	.0007
.84	16.0	-.0124	-.0061	-.0046	-.0088	.0011
.95	-4.0	-.2863	.0738	.0569	-.0238	-.0105
.95	.0	-.2688	.0501	.0525	-.0267	-.0062
.95	4.0	-.1699	.0289	.0219	-.0196	-.0037
.95	8.0	-.0864	.0135	.0130	-.0117	-.0022
.95	12.0	-.0878	.0029	.0106	-.0097	-.0007
.95	16.0	-.0663	-.0059	.0028	-.0067	-.0000
.95	20.0	-.0412	-.0230	.0038	-.0021	.0018
1.01	-4.0	-.1422	.0716	.0199	-.0157	-.0099
1.01	.0	-.1673	.0509	.0138	-.0158	-.0088
1.01	4.0	-.1283	.0254	.0144	-.0137	-.0071
1.01	8.0	-.1021	.0098	.0111	-.0110	-.0028
1.01	12.0	-.0949	-.0035	.0149	-.0090	-.0013
1.01	16.0	-.0783	-.0122	.0023	-.0077	-.0001
1.01	20.0	-.0282	.0001	-.0122	-.0032	.0001
1.01	24.0	-.0268	-.0186	-.0061	-.0008	.0013
1.07	-4.0	-.1408	.0600	-.0067	-.0136	-.0098
1.07	.0	-.1624	.0454	.0139	-.0149	-.0065
1.07	4.0	-.1238	.0226	.0206	-.0123	-.0045
1.07	8.0	-.0923	.0088	.0115	-.0101	-.0033
1.07	12.0	-.0863	-.0056	.0118	-.0085	-.0021
1.07	16.0	-.0776	-.0158	.0071	-.0078	-.0018
1.07	20.0	-.0748	-.0261	.0040	-.0070	-.0005
1.07	24.0	-.0704	-.0215	-.0030	-.0038	-.0010
1.12	-4.0	-.1282	.0585	-.0074	-.0131	-.0078
1.12	.0	-.1615	.0463	.0095	-.0144	-.0066
1.12	4.0	-.1190	.0198	.0247	-.0113	-.0048
1.12	8.0	-.0916	.0065	.0158	-.0097	-.0034
1.12	12.0	-.0783	.0003	.0138	-.0076	-.0020
1.12	16.0	-.0727	-.0132	.0106	-.0077	-.0010
1.12	20.0	-.0720	-.0181	.0114	-.0063	-.0003
1.12	24.0	-.0666	-.0256	.0075	-.0052	.0003
1.20	-4.0	-.1864	.0559	.0011	-.0135	-.0081
1.20	.0	-.1092	.0400	.0137	-.0118	-.0063
1.20	4.0	-.0868	.0237	.0117	-.0090	-.0044
1.20	8.0	-.0737	.0144	.0087	-.0083	-.0027
1.20	12.0	-.0708	.0013	.0113	-.0076	-.0018
1.20	16.0	-.0673	-.0097	.0139	-.0070	-.0007
1.20	20.0	-.0570	-.0192	.0145	-.0068	.0003

$\delta_s = -.10c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	-4.0	-.2386	.0558	.0073	-.0249	-.0103
.62	.0	-.2708	.0568	.0293	-.0273	-.0087
.62	4.0	-.2938	.0375	.0110	-.0319	-.0067
.62	8.0	-.2358	.0148	.0110	-.0279	-.0039
.62	12.0	-.0686	-.0054	.0057	-.0187	-.0024
.62	16.0	.0419	.0021	.0095	-.0021	-.0027
.84	-4.0	-.3171	.0787	.0463	-.0304	-.0121
.84	.0	-.3498	.0690	.0408	-.0358	-.0099
.84	4.0	-.3838	.0486	.0249	-.0386	-.0071
.84	8.0	-.3070	.0076	.0188	-.0329	-.0025
.84	12.0	-.1339	-.0132	.0102	-.0173	-.0006
.84	16.0	-.0003	-.0095	.0042	-.0026	-.0018
.95	-4.0	-.3356	.0991	.0678	-.0296	-.0143
.95	.0	-.3471	.0766	.0602	-.0347	-.0101
.95	4.0	-.3175	.0450	.0394	-.0335	-.0069
.95	6.0	-.1988	.0124	.0371	-.0226	-.0034
.95	12.0	-.1572	-.0052	.0270	-.0179	-.0024
.95	16.0	-.1005	-.0076	.0083	-.0127	-.0018
.95	20.0	-.0302	-.0247	.0049	-.0086	-.0006
1.01	-4.0	-.2038	.1038	.0230	-.0286	-.0144
1.01	.0	-.2457	.0776	.0166	-.0251	-.0130
1.01	4.0	-.2621	.0439	.0299	-.0259	-.0108
1.01	8.0	-.1805	.0158	.0308	-.0193	-.0058
1.01	12.0	-.1440	-.0035	.0284	-.0160	-.0035
1.01	16.0	-.1201	-.0161	.0117	-.0146	-.0017
1.01	20.0	-.0477	.0017	-.0143	-.0096	-.0015
1.01	24.0	.0045	-.0109	-.0113	-.0030	-.0013
1.07	-4.0	-.1846	.0938	-.0057	-.0199	-.0130
1.07	.0	-.2221	.0745	.0189	-.0234	-.0103
1.07	4.0	-.2246	.0424	.0344	-.0214	-.0076
1.07	8.0	-.1679	.0177	.0283	-.0178	-.0052
1.07	12.0	-.1411	-.0048	.0261	-.0153	-.0034
1.07	16.0	-.1134	-.0147	.0150	-.0136	-.0016
1.07	20.0	-.1036	-.0222	.0139	-.0133	.0001
1.07	24.0	-.0883	-.0228	-.0000	-.0101	.0004
1.12	-4.0	-.1820	.0891	-.0103	-.0165	-.0118
1.12	.0	-.2336	.0734	.0066	-.0235	-.0113
1.12	4.0	-.2055	.0404	.0371	-.0196	-.0074
1.12	8.0	-.1610	.0156	.0321	-.0171	-.0049
1.12	12.0	-.1283	.0018	.0258	-.0147	-.0029
1.12	16.0	-.1036	-.0137	.0221	-.0140	-.0011
1.12	20.0	-.0999	-.0242	.0228	-.0119	.0003
1.12	24.0	-.1147	-.0346	.0170	-.0114	.0011
1.20	-4.0	-.1838	.0870	-.0007	-.0192	-.0113
1.20	.0	-.2000	.0687	.0173	-.0207	-.0102
1.20	4.0	-.1677	.0395	.0263	-.0161	-.0069
1.20	8.0	-.1354	.0216	.0224	-.0146	-.0046
1.20	12.0	-.1206	.0018	.0228	-.0129	-.0023
1.20	16.0	-.1061	-.0121	.0256	-.0119	-.0008
1.20	20.0	-.0869	-.0249	.0248	-.0104	.0007

Table II.—Spoiler, Gap, and Lip



$\delta_s = .05c$							$\delta_s = .075c$						
M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$	M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	-4.0	-.0966	.0140	-.0037	-.0025	-.0039	.62	-4.0	-.1558	.0383	.0019	-.0163	-.0063
.62	.0	-.1141	.0225	.0110	-.0065	-.0032	.62	.0	-.1866	.0350	.0147	-.0184	-.0060
.62	4.0	-.1425	.0149	-.0073	-.0110	-.0081	.62	4.0	-.2065	.0275	.0038	-.0241	-.0040
.62	8.0	-.1047	.0184	-.0037	-.0089	-.0015	.62	8.0	-.1858	.0113	.0037	-.0226	-.0027
.62	12.0	-.0393	.0007	.0049	-.0034	-.0003	.62	12.0	-.0891	-.0048	.0088	-.0143	-.0018
.62	16.0	.0248	.0044	.0044	.0021	.0001	.62	16.0	-.0058	-.0059	.0120	-.0075	-.0004
.84	-4.0	-.1676	.0237	.0251	-.0107	-.0040	.84	-4.0	-.2135	.0475	.0327	-.0206	-.0075
.84	.0	-.3030	.0275	.0265	-.0135	-.0039	.84	.0	-.2334	.0434	.0366	-.0227	-.0061
.84	4.0	-.1775	.0186	.0089	-.0185	-.0027	.84	4.0	-.2722	.0275	.0165	-.0285	-.0043
.84	8.0	-.1483	.0037	.0037	-.0163	-.0007	.84	8.0	-.2222	.0035	.0138	-.0253	-.0017
.84	12.0	-.0799	-.0066	.0071	-.0097	.0002	.84	12.0	-.1387	-.0137	.0084	-.0169	-.0003
.84	16.0	-.0178	-.0071	.0063	-.0042	.0003	.84	16.0	-.0388	-.0163	.0189	-.0079	-.0002
.95	-4.0	-.1952	.0341	.0446	-.0151	-.0061	.95	-4.0	-.2588	.0607	.0572	-.0224	-.0089
.95	.0	-.1843	.0319	.0438	-.0167	-.0040	.95	.0	-.2575	.0504	.0542	-.0254	-.0069
.95	4.0	-.1008	.0106	.0208	-.0125	-.0027	.95	4.0	-.1793	.0297	.0308	-.0211	-.0049
.95	8.0	-.0846	-.0011	.0248	-.0102	-.0014	.95	8.0	-.1225	.0063	.0301	-.0158	-.0055
.95	12.0	-.1018	-.0127	.0233	-.0104	-.0009	.95	12.0	-.1461	-.0201	.0484	-.0160	-.0001
.95	16.0	-.0684	-.0175	.0118	-.0082	-.0005	.95	16.0	-.1107	-.0287	.0341	-.0131	.0001
.95	20.0	-.0163	-.0193	.0177	.0008	-.0011	.95	20.0	-.0630	-.0364	.0247	-.0064	.0010
1.01	-4.0	-.0888	.0352	.0260	-.0095	-.0061	1.01	-4.0	-.1322	.0610	.0269	-.0153	-.0090
1.01	.0	-.1276	.0239	.0243	-.0117	-.0058	1.01	.0	-.1780	.0453	.0284	-.0180	-.0089
1.01	4.0	-.0946	.0072	.0182	-.0108	-.0051	1.01	4.0	-.1554	.0203	.0340	-.0166	-.0072
1.01	8.0	-.1072	-.0054	.0246	-.0106	-.0017	1.01	8.0	-.1412	.0015	.0374	-.0152	-.0025
1.01	12.0	-.1142	-.0208	.0309	-.0102	-.0000	1.01	12.0	-.1402	-.0190	.0427	-.0141	-.0007
1.01	16.0	-.0944	-.0283	.0164	-.0091	.0008	1.01	16.0	-.1199	-.0312	.0264	-.0133	-.0000
1.01	20.0	-.0427	-.0180	-.0006	-.0061	.0011	1.01	20.0	-.0580	-.0190	-.0022	-.0089	.0006
1.01	24.0	.0218	-.0194	.0060	.0013	.0006	1.01	24.0	-.0338	-.0422	.0139	-.0052	.0018
1.07	-4.0	-.0970	.0270	-.0029	-.0083	-.0057	1.07	-4.0	-.1262	.0531	-.0011	-.0133	-.0085
1.07	.0	-.0841	.0186	.0222	-.0082	-.0040	1.07	.0	-.1605	.0411	.0261	-.0161	-.0070
1.07	4.0	-.0762	.0091	.0198	-.0081	-.0026	1.07	4.0	-.1332	.0194	.0403	-.0136	-.0042
1.07	8.0	-.0932	-.0062	.0244	-.0091	-.0023	1.07	8.0	-.1407	.0009	.0406	-.0146	-.0025
1.07	12.0	-.0987	-.0196	.0264	-.0093	-.0014	1.07	12.0	-.1438	-.0196	.0437	-.0147	-.0015
1.07	16.0	-.0858	-.0269	.0195	-.0087	-.0006	1.07	16.0	-.1183	-.0313	.0359	-.0136	.0002
1.07	20.0	-.0946	-.0391	.0167	-.0096	.0016	1.07	20.0	-.1154	-.0406	.0292	-.0129	.0025
1.07	24.0	-.0763	-.0381	.0002	-.0056	.0023	1.07	24.0	-.1016	-.0456	.0118	-.0101	.0032
1.12	-4.0	-.0779	.0240	-.0048	-.0075	-.0045	1.12	-4.0	-.1158	.0487	-.0030	-.0127	-.0073
1.12	.0	-.0908	.0195	.0147	-.0084	-.0036	1.12	.0	-.1566	.0397	.0252	-.0163	-.0063
1.12	4.0	-.0795	.0052	.0235	-.0063	-.0030	1.12	4.0	-.1266	.0147	.0399	-.0133	-.0045
1.12	8.0	-.0803	-.0070	.0255	-.0087	-.0022	1.12	8.0	-.1175	-.0027	.0401	-.0133	-.0028
1.12	12.0	-.0945	-.0135	.0284	-.0092	-.0010	1.12	12.0	-.1273	-.0155	.0432	-.0134	-.0010
1.12	16.0	-.0810	-.0265	.0236	-.0094	.0003	1.12	16.0	-.1106	-.0308	.0375	-.0130	.0004
1.12	20.0	-.0856	-.0317	.0247	-.0090	.0021	1.12	20.0	-.1117	-.0414	.0377	-.0123	.0019
1.12	24.0	-.1035	-.0508	.0163	-.0081	.0035	1.12	24.0	-.1292	-.0644	.0314	-.0116	.0036
1.20	-4.0	-.0756	.0215	.0055	-.0071	-.0042	1.20	-4.0	-.1215	.0447	.0073	-.0122	-.0071
1.20	.0	-.0522	.0163	.0103	-.0051	-.0032	1.20	.0	-.1106	.0361	.0250	-.0118	-.0055
1.20	4.0	-.0639	.0083	.0123	-.0066	-.0025	1.20	4.0	-.1014	.0189	.0262	-.0112	-.0034
1.20	8.0	-.0724	.0011	.0198	-.0075	-.0009	1.20	8.0	-.0983	.0077	.0309	-.0114	-.0016
1.20	12.0	-.0924	-.0139	.0253	-.0087	-.0000	1.20	12.0	-.1149	-.0113	.0366	-.0122	.0004
1.20	16.0	-.0944	-.0235	.0272	-.0087	.0011	1.20	16.0	-.1107	-.0235	.0385	-.0119	.0015
1.20	20.0	-.0875	-.0366	.0282	-.0093	.0027	1.20	20.0	-.1097	-.0393	.0377	-.0115	.0038

CO[redacted]

[redacted]

Table II.— Concluded.

$\delta_s = -10c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	- 4.0	-.2261	.0606	.0130	-.0238	-.0101
.62	.0	-.2667	.0614	-.0314	-.0276	-.0090
.62	4.0	-.3184	.0470	.0149	-.0343	-.0068
.62	8.0	-.2829	.0191	.0185	-.0328	-.0040
.62	12.0	-.1267	-.0026	.0254	-.0185	-.0018
.62	16.0	-.0279	-.0020	.0269	-.0091	-.0007
.84	- 4.0	-.2803	.0760	.0491	-.0278	-.0123
.84	.0	-.3248	.0699	.0517	-.0329	-.0100
.84	4.0	-.3805	.0494	.0304	-.0386	-.0072
.84	6.0	-.3233	.0127	.0239	-.0355	-.0028
.84	12.0	-.1794	-.0105	.0148	-.0225	.0001
.84	16.0	-.0397	-.0100	.0168	-.0082	-.0009
.95	- 4.0	-.3253	.0997	.0688	-.0289	-.0151
.95	.0	-.3354	.0806	.0641	-.0327	-.0109
.95	4.0	-.2965	.0587	.0430	-.0326	-.0085
.95	8.0	-.1842	.0271	.0356	-.0227	-.0050
.98	12.0	-.1921	-.0092	.0460	-.0215	-.0016
.95	16.0	-.1560	-.0318	.0474	-.0179	.0007
.95	20.0	-.0859	-.0407	.0315	-.0077	.0012
1.01	- 4.0	-.1860	.0988	.0278	-.0214	-.0146
1.01	.0	-.2535	.0776	.0294	-.0255	-.0135
1.01	4.0	-.2803	.0444	.0497	-.0281	-.0105
1.01	8.0	-.2024	.0150	.0490	-.0218	-.0046
1.01	12.0	-.1894	-.0112	.0534	-.0200	-.0016
1.01	16.0	-.1601	-.0276	.0382	-.0180	-.0000
1.01	20.0	-.0943	-.0184	.0045	-.0132	.0016
1.01	24.0	-.0364	-.0351	.0081	-.0065	.0019
1.07	- 4.0	-.1818	.0876	-.0022	-.0196	-.0133
1.07	.0	-.2346	.0736	.0271	-.0246	-.0108
1.07	4.0	-.2290	.0414	.0513	-.0227	-.0076
1.07	8.0	-.1897	.0144	.0467	-.0199	-.0051
1.07	12.0	-.1821	-.0120	.0518	-.0190	-.0028
1.07	16.0	-.2546	-.0271	.0422	-.0175	-.0000
1.07	20.0	-.1534	-.0461	.0375	-.0164	.0023
1.07	24.0	-.1417	-.0573	.0242	-.0140	.0047
1.12	- 4.0	-.1741	.0837	-.0068	-.0189	-.0122
1.12	.0	-.2363	.0717	.0204	-.0247	-.0103
1.12	4.0	-.2278	.0370	.0534	-.0223	-.0077
1.12	8.0	-.1836	.0110	.0507	-.0192	-.0044
1.12	12.0	-.1672	-.0054	.0499	-.0178	-.0025
1.12	16.0	-.1493	-.0273	.0472	-.0173	-.0002
1.12	20.0	-.1428	-.0404	.0455	-.0152	.0021
1.12	24.0	-.1609	-.0685	.0411	-.0149	.0044
1.20	- 4.0	-.1861	.0799	.0054	-.0189	-.0120
1.20	.0	-.2033	.0690	.0277	-.0221	-.0102
1.20	4.0	-.1786	.0392	.0391	-.0181	-.0071
1.20	8.0	-.1580	.0206	.0402	-.0168	-.0035
1.20	12.0	-.1553	-.0052	.0450	-.0166	-.0013
1.20	16.0	-.1523	-.0247	.0478	-.0158	.0006
1.20	20.0	-.1384	-.0421	.0453	-.0145	.0026

[redacted]

CONFID

Table III.— Spoiler, Slot, and Deflector

$\delta_s = -.025c$; $\delta_d = .018c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	- 4.0	-.0246	.0051	.0055	-.0008	-.0032
.62	.0	-.0671	.0137	.0147	-.0061	-.0030
.62	4.0	-.0650	.0090	-.0073	-.0099	-.0025
.62	8.0	-.0520	.0102	-.0018	-.0076	-.0025
.62	12.0	-.0303	.0031	.0051	-.0071	-.0020
.62	16.0	-.0005	.0037	.0084	-.0041	-.0007
.84	- 4.0	-.0407	.0126	.0390	-.0027	-.0035
.84	.0	-.0917	.0227	.0376	-.0086	-.0049
.84	4.0	-.0980	.0154	.0152	-.0114	-.0025
.84	8.0	-.1059	.0073	.0113	-.0116	-.0015
.84	12.0	-.0665	-.0000	.0136	-.0079	-.0008
.84	16.0	-.0516	-.0068	.0131	-.0083	-.0008
.95	- 4.0	-.1311	.0210	.0577	-.0098	-.0053
.95	.0	-.0835	.0270	.0475	-.0094	-.0036
.95	4.0	-.0403	.0238	.0275	-.0075	-.0036
.95	8.0	-.0675	.0185	.0456	-.0082	-.0027
.95	12.0	-.1102	-.0012	.0392	-.0100	-.0015
.95	16.0	-.0675	-.0052	.0154	-.0062	-.0012
.95	20.0	-.0532	-.0264	.0183	-.0042	.0001
1.01	- 4.0	-.0489	.0194	.0435	-.0065	-.0042
1.01	.0	-.0277	.0120	.0137	-.0042	-.0045
1.01	4.0	-.0250	.0102	.0089	-.0047	-.0054
1.01	8.0	-.0410	.0078	.0165	-.0050	-.0026
1.01	12.0	-.0765	-.0052	.0262	-.0068	-.0014
1.01	16.0	-.0757	-.0149	.0099	-.0077	-.0008
1.01	20.0	-.0184	.0020	-.0196	-.0027	-.0003
1.01	24.0	.0269	-.0076	.0060	.0013	-.0013
1.07	- 4.0	-.0289	.0061	.0088	-.0038	-.0037
1.07	.0	-.0153	.0084	.0081	-.0037	-.0025
1.07	4.0	-.0208	.0088	.0133	-.0034	-.0029
1.07	8.0	-.0408	.0083	.0147	-.0045	-.0025
1.07	12.0	-.0715	-.0073	.0208	-.0061	-.0022
1.07	16.0	-.0635	-.0176	.0142	-.0077	-.0008
1.07	20.0	-.0629	-.0182	-.0054	-.0063	.0005
1.07	24.0	-.0380	-.0142	-.0158	-.0032	.0008
1.12	- 4.0	-.0319	.0070	.0057	-.0034	-.0024
1.12	.0	-.0298	.0082	.0040	-.0032	-.0028
1.12	4.0	-.0219	.0050	.0119	-.0030	-.0027
1.12	8.0	-.0304	.0013	.0170	-.0035	-.0022
1.12	12.0	-.0647	-.0040	.0221	-.0054	-.0017
1.12	16.0	-.0801	-.0174	.0164	-.0077	-.0001
1.12	20.0	-.0659	-.0159	.0028	-.0054	.0005
1.12	24.0	-.0830	-.0294	-.0041	-.0047	.0013
1.20	- 4.0	-.0156	.0049	-.0001	-.0022	-.0022
1.20	.0	-.0159	.0070	.0001	-.0034	-.0023
1.20	4.0	-.0299	.0048	.0004	-.0035	-.0022
1.20	8.0	-.0212	.0062	.0060	-.0032	-.0018
1.20	12.0	-.0554	-.0021	.0145	-.0052	-.0005
1.20	16.0	-.0680	-.0070	.0155	-.0062	.0008
1.20	20.0	-.0688	-.0175	.0055	-.0068	.0016

$\delta_s = -.05c$; $\delta_d = .037c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	- 4.0	-.1103	.0357	.0275	-.0080	-.0070
.62	.0	-.1624	.0424	.0458	-.0164	-.0061
.62	4.0	-.1961	.0270	.0238	-.0217	-.0043
.62	8.0	-.1559	.0134	.0256	-.0202	-.0026
.62	12.0	-.0990	-.0051	.0294	-.0148	-.0018
.62	16.0	-.0048	.0085	.0221	-.0069	-.0002
.84	- 4.0	-.1610	.0500	.0614	-.0144	-.0085
.84	.0	-.1829	.0508	.0601	-.0176	-.0074
.84	4.0	-.2212	.0382	.0425	-.0237	-.0052
.84	8.0	-.2165	.0105	.0401	-.0247	-.0017
.84	12.0	-.1650	-.0121	.0439	-.0198	.0003
.84	16.0	-.0905	-.0168	.0452	-.0130	.0006
.95	- 4.0	-.2354	.0613	.0789	-.0197	-.0093
.95	.0	-.1920	.0548	.0624	-.0205	-.0075
.95	4.0	-.1476	.0369	.0591	-.0188	-.0054
.95	8.0	-.1442	.0189	.0655	-.0172	-.0030
.95	12.0	-.2058	-.0164	.0649	-.0203	-.0003
.95	16.0	-.1917	-.0388	.0716	-.0184	.0015
.95	20.0	-.0619	-.0242	.0408	-.0060	-.0001
1.01	- 4.0	-.1247	.0537	.0542	-.0146	-.0079
1.01	.0	-.1266	.0378	.0384	-.0151	-.0078
1.01	4.0	-.0947	.0260	.0351	-.0123	-.0072
1.01	8.0	-.1143	.0093	.0448	-.0135	-.0033
1.01	12.0	-.1382	-.0105	.0543	-.0150	-.0013
1.01	16.0	-.1414	-.0317	.0427	-.0165	.0004
1.01	20.0	-.0813	-.0285	.0157	-.0117	.0011
1.01	24.0	.0201	-.0094	.0300	-.0040	-.0003
1.07	- 4.0	-.1162	.0419	.0250	-.0121	-.0073
1.07	.0	-.1236	.0335	.0426	-.0128	-.0059
1.07	4.0	-.0882	.0245	.0384	-.0104	-.0045
1.07	8.0	-.0985	.0110	.0401	-.0117	-.0029
1.07	12.0	-.1276	-.0093	.0507	-.0134	-.0022
1.07	16.0	-.1365	-.0275	.0476	-.0164	.0005
1.07	20.0	-.1217	-.0356	.0295	-.0138	.0021
1.07	24.0	-.1032	-.0387	.0136	-.0109	.0030
1.12	- 4.0	-.0968	.0390	.0222	-.0108	-.0065
1.12	.0	-.1058	.0318	.0325	-.0112	-.0050
1.12	4.0	-.0717	.0204	.0380	-.0093	-.0044
1.12	8.0	-.0847	.0066	.0425	-.0105	-.0036
1.12	12.0	-.1143	-.0045	.0509	-.0126	-.0018
1.12	16.0	-.1287	-.0254	.0496	-.0151	.0008
1.12	20.0	-.1209	-.0339	.0370	-.0130	.0017
1.12	24.0	-.1291	-.0538	.0292	-.0124	.0030
1.20	- 4.0	-.0988	.0368	.0285	-.0106	-.0066
1.20	.0	-.0726	.0285	.0274	-.0082	-.0049
1.20	4.0	-.0665	.0190	.0226	-.0081	-.0039
1.20	8.0	-.0717	.0131	.0318	-.0088	-.0021
1.20	12.0	-.0943	-.0028	.0431	-.0104	-.0014
1.20	16.0	-.1164	-.0200	.0498	-.0123	.0005
1.20	20.0	-.1080	-.0347	.0399	-.0118	.0021

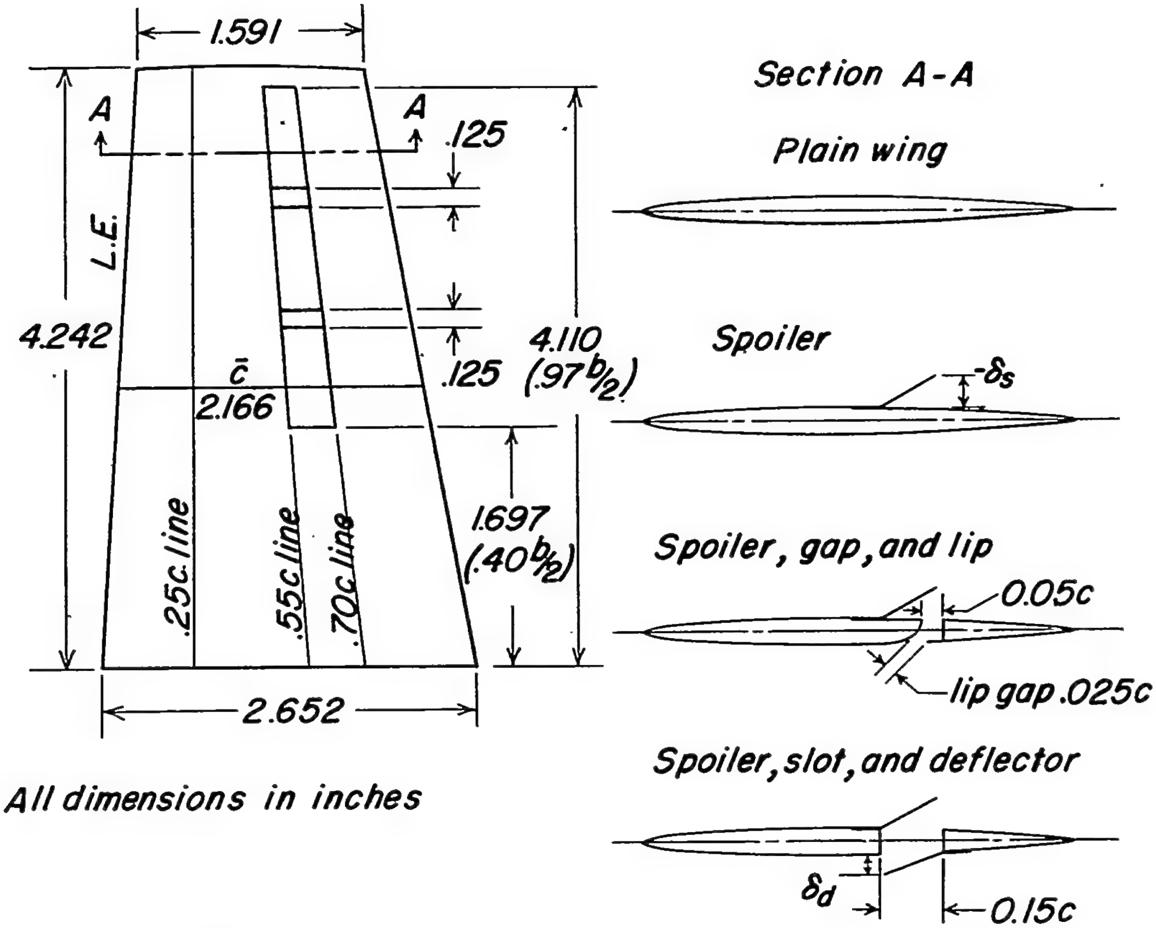
Table III.—Concluded.

$\delta_s = .075c$, $\delta_d = .056c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	- 4.0	-.1846	.0660	.0295	-.0192	-.0110
.62	.0	-.2709	.0717	.0589	-.0275	-.0095
.62	4.0	-.3367	.0515	.0443	-.0361	-.0077
.62	8.0	-.3304	.0187	.0424	-.0366	-.0047
.62	12.0	-.2240	-.0111	.0514	-.0274	-.0026
.62	16.0	-.1220	-.0186	.0830	-.0176	-.0010
.84	- 4.0	-.2114	.0775	.0654	-.0201	-.0185
.84	.0	-.2395	.0768	.0629	-.0281	-.0106
.84	4.0	-.3398	.0543	.0465	-.0358	-.0084
.84	8.0	-.3698	.0142	.0591	-.0394	-.0033
.84	12.0	-.3105	-.0193	.0540	-.0337	-.0001
.84	16.0	-.1839	-.0297	.0739	-.0282	.0007
.95	- 4.0	-.2916	.0886	.0684	-.0264	-.0145
.95	.0	-.2496	.0611	.0496	-.0274	-.0119
.95	4.0	-.2577	.0618	.0627	-.0298	-.0088
.95	8.0	-.2581	.0242	.0798	-.0288	-.0046
.95	12.0	-.2795	-.0083	.0835	-.0292	-.0019
.95	16.0	-.2931	-.0216	.0843	-.0298	.0015
.95	20.0	-.1664	-.0452	.0740	-.0162	.0014
1.01	- 4.0	-.1823	.0906	.0412	-.0213	-.0131
1.01	.0	-.2106	.0696	.0325	-.0239	-.0120
1.01	4.0	-.2090	.0446	.0299	-.0289	-.0103
1.01	8.0	-.2164	.0190	.0564	-.0230	-.0048
1.01	12.0	-.2494	-.0157	.0777	-.0254	-.0016
1.01	16.0	-.2471	-.0484	.0700	-.0272	.0012
1.01	20.0	-.1881	-.0434	.0406	-.0234	.0032
1.01	24.0	-.1240	-.0851	.0475	-.0146	.0047
1.07	- 4.0	-.1718	.0765	.0105	-.0190	-.0120
1.07	.0	-.2076	.0632	.0299	-.0224	-.0099
1.07	4.0	-.1842	.0410	.0493	-.0199	-.0074
1.07	8.0	-.1913	.0175	.0538	-.0206	-.0055
1.07	12.0	-.2148	-.0113	.0661	-.0227	-.0027
1.07	16.0	-.2317	-.0414	.0726	-.0257	.0004
1.07	20.0	-.2378	-.0692	.0688	-.0264	.0043
1.07	24.0	-.2026	-.0794	.0460	-.0220	.0060
1.12	- 4.0	-.1621	.0744	.0054	-.0183	-.0110
1.12	.0	-.1984	.0685	.0260	-.0219	-.0097
1.12	4.0	-.1710	.0370	.0486	-.0184	-.0075
1.12	8.0	-.1719	.0164	.0528	-.0192	-.0081
1.12	12.0	-.2051	-.0054	.0638	-.0218	-.0021
1.12	16.0	-.2136	-.0368	.0700	-.0246	.0005
1.12	20.0	-.2253	-.0897	.0704	-.0249	.0042
1.12	24.0	-.2324	-.0914	.0588	-.0235	.0079
1.20	- 4.0	-.1657	.0697	.0134	-.0177	-.0107
1.20	.0	-.1544	.0564	.0294	-.0181	-.0090
1.20	4.0	-.1466	.0354	.0299	-.0160	-.0063
1.20	8.0	-.1485	.0215	.0394	-.0164	-.0041
1.20	12.0	-.1763	-.0017	.0517	-.0183	-.0015
1.20	16.0	-.1982	-.0269	.0640	-.0203	.0009
1.20	20.0	-.2165	-.0578	.0690	-.0216	.0046

$\delta_s = .10c$, $\delta_d = .075c$

M	α	ΔC_L	ΔC_D	ΔC_m	$-C_l$	$-C_n$
.62	- 4.0	-.2797	.1155	.0616	-.0306	-.0180
.62	.0	-.3751	.1173	.0847	-.0415	-.0164
.62	4.0	-.4462	.0952	.0720	-.0486	-.0133
.62	8.0	-.4732	.0527	.0774	-.0525	-.0090
.62	12.0	-.3573	.0103	.0974	-.0431	-.0047
.62	16.0	-.2534	-.0078	.1046	-.0339	-.0010
.84	- 4.0	-.3009	.1273	.0805	-.0308	-.0186
.84	.0	-.3641	.1273	.0861	-.0392	-.0201
.84	4.0	-.4742	.1028	.0756	-.0516	-.0139
.84	8.0	-.4742	.0514	.0806	-.0515	-.0079
.84	12.0	-.3885	.0074	.0766	-.0435	-.0034
.84	16.0	-.2770	-.0168	.1129	-.0329	-.0006
.95	- 4.0	-.3697	.1231	.0905	-.0370	-.0205
.95	.0	-.3675	.1429	.0904	-.0428	-.0187
.95	4.0	-.4075	.1135	.0936	-.0470	-.0152
.95	8.0	-.3689	.0574	.1175	-.0424	-.0089
.95	12.0	-.4123	.0064	.1419	-.0451	-.0030
.95	16.0	-.4856	-.0456	.1449	-.0456	.0019
.95	20.0	-.3168	-.0600	.1302	-.0326	.0036
1.01	- 4.0	-.2733	.1506	.0621	-.0327	-.0213
1.01	.0	-.3203	.1269	.0607	-.0371	-.0197
1.01	4.0	-.3963	.0915	.1041	-.0418	-.0165
1.01	8.0	-.3497	.0499	.1139	-.0379	-.0091
1.01	12.0	-.3573	.0083	.1320	-.0385	-.0043
1.01	16.0	-.3738	-.0377	.1305	-.0408	.0007
1.01	20.0	-.3842	-.0579	.0938	-.0379	.0020
1.01	24.0	-.2601	-.0836	.0986	-.0308	.0068
1.07	- 4.0	-.2645	.1363	.0325	-.0301	-.0200
1.07	.0	-.3081	.1167	.0558	-.0349	-.0171
1.07	4.0	-.3416	.0856	.1010	-.0358	-.0131
1.07	8.0	-.3114	.0470	.1065	-.0339	-.0090
1.07	12.0	-.3317	.0081	.1208	-.0354	-.0052
1.07	16.0	-.3524	-.0365	.1293	-.0381	-.0003
1.07	20.0	-.3614	-.0789	.1268	-.0388	.0053
1.07	24.0	-.3661	-.1156	.1036	-.0363	.0097
1.12	- 4.0	-.2573	.1317	.0276	-.0290	-.0187
1.12	.0	-.3128	.1142	.0501	-.0349	-.0168
1.12	4.0	-.3200	.0801	.0966	-.0338	-.0132
1.12	8.0	-.2968	.0434	.1047	-.0323	-.0084
1.12	12.0	-.3092	.0125	.1167	-.0333	-.0042
1.12	16.0	-.3349	-.0325	.1275	-.0365	.0001
1.12	20.0	-.3426	-.0674	.1299	-.0371	.0056
1.12	24.0	-.3789	-.1203	.1179	-.0368	.0106
1.20	- 4.0	-.2585	.1288	.0346	-.0292	-.0181
1.20	.0	-.2656	.1072	.0552	-.0320	-.0150
1.20	4.0	-.2640	.0736	.0712	-.0284	-.0114
1.20	8.0	-.2482	.0501	.0825	-.0277	-.0073
1.20	12.0	-.2720	.0154	.0994	-.0294	-.0034
1.20	16.0	-.3039	-.0233	.1171	-.0324	.0004
1.20	20.0	-.3175	-.0661	.1239	-.0339	.0055



Wing Data

Semispan area	9.0 sq in.
Aspect ratio	4
Taper ratio	0.6
Section	NACA 65A006
Quarter-chord sweepback	0.0°

Figure 1.- General arrangement of model and controls.

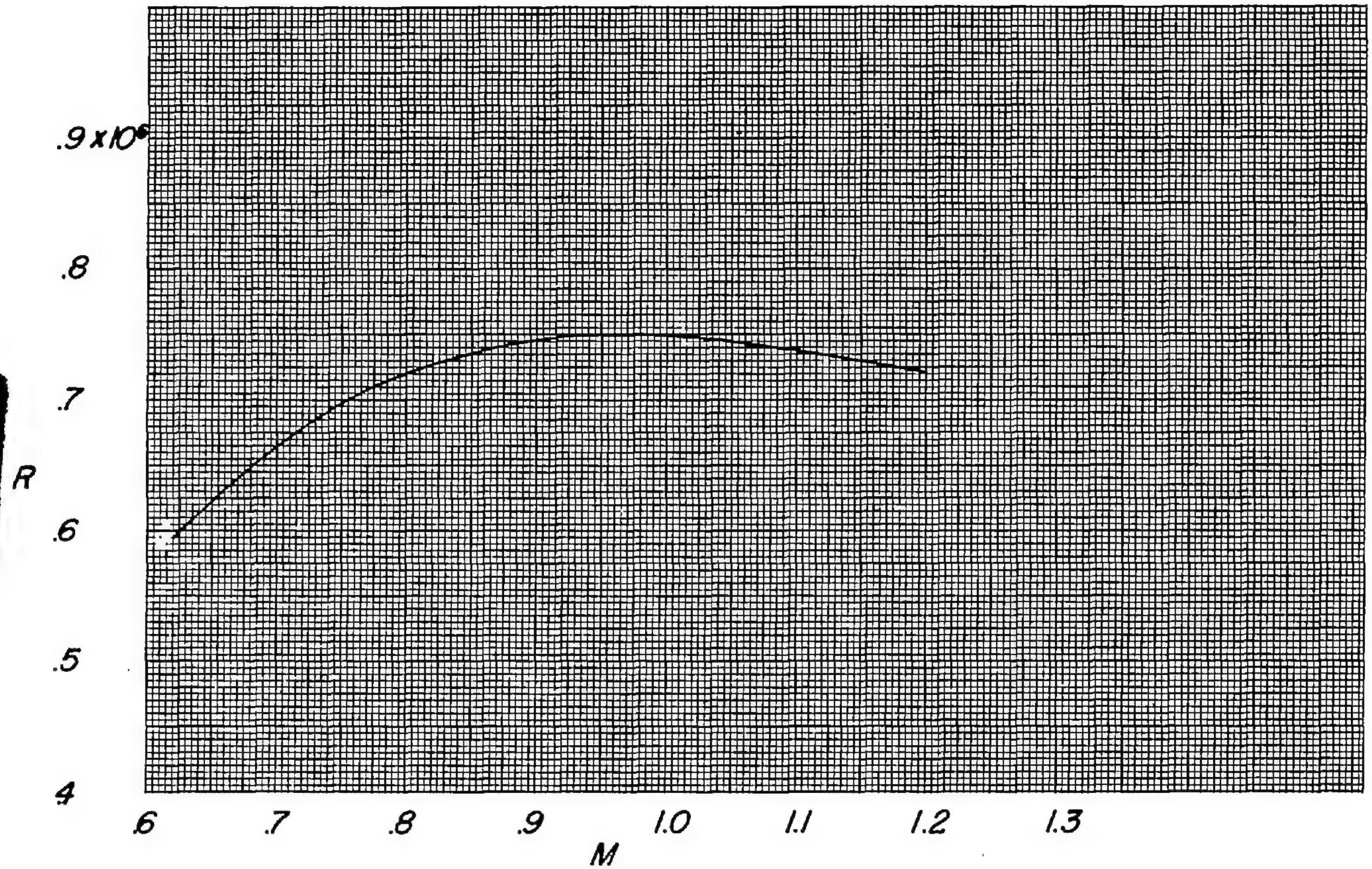


Figure 2.- Variation of mean Reynolds number with Mach number.

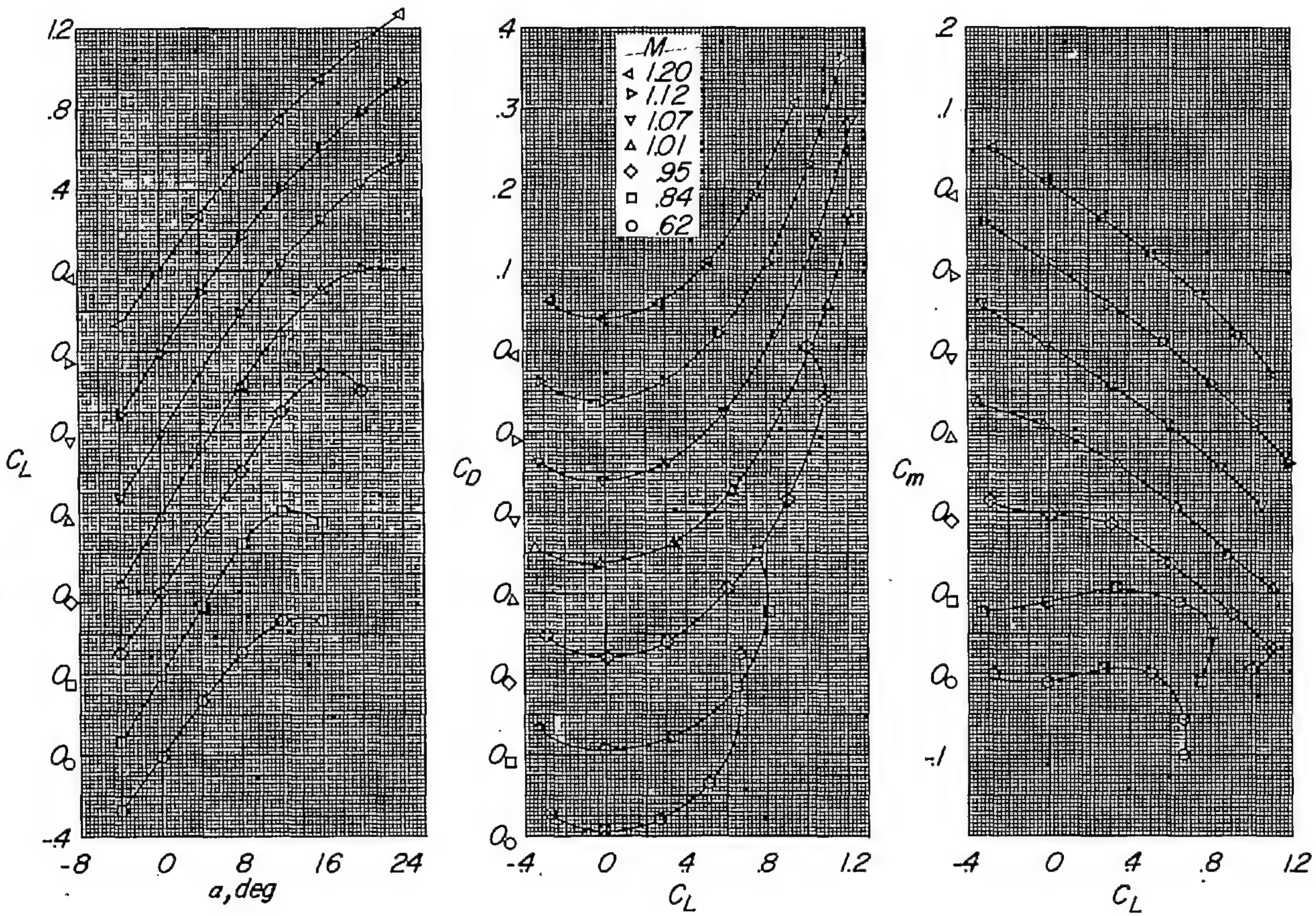
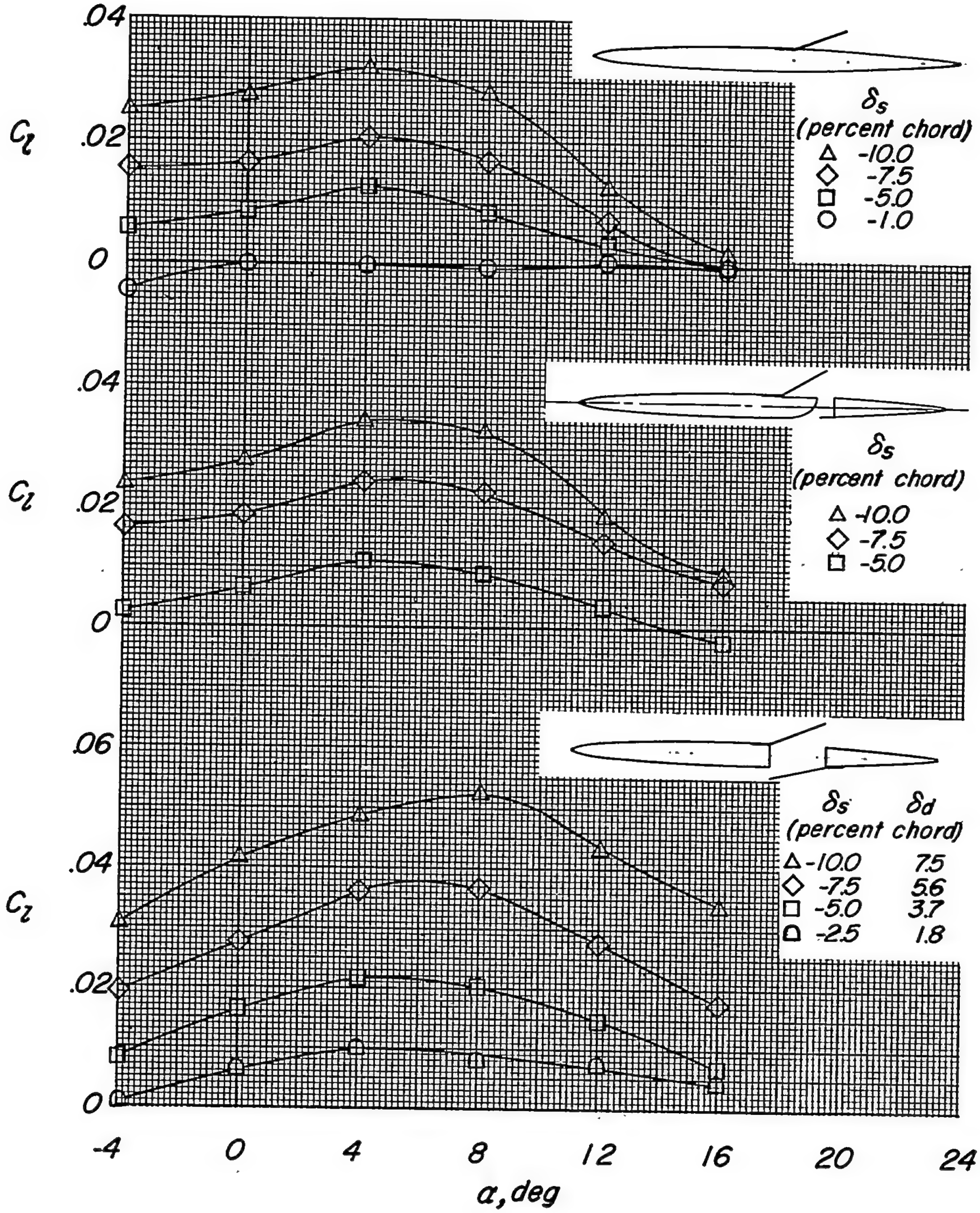
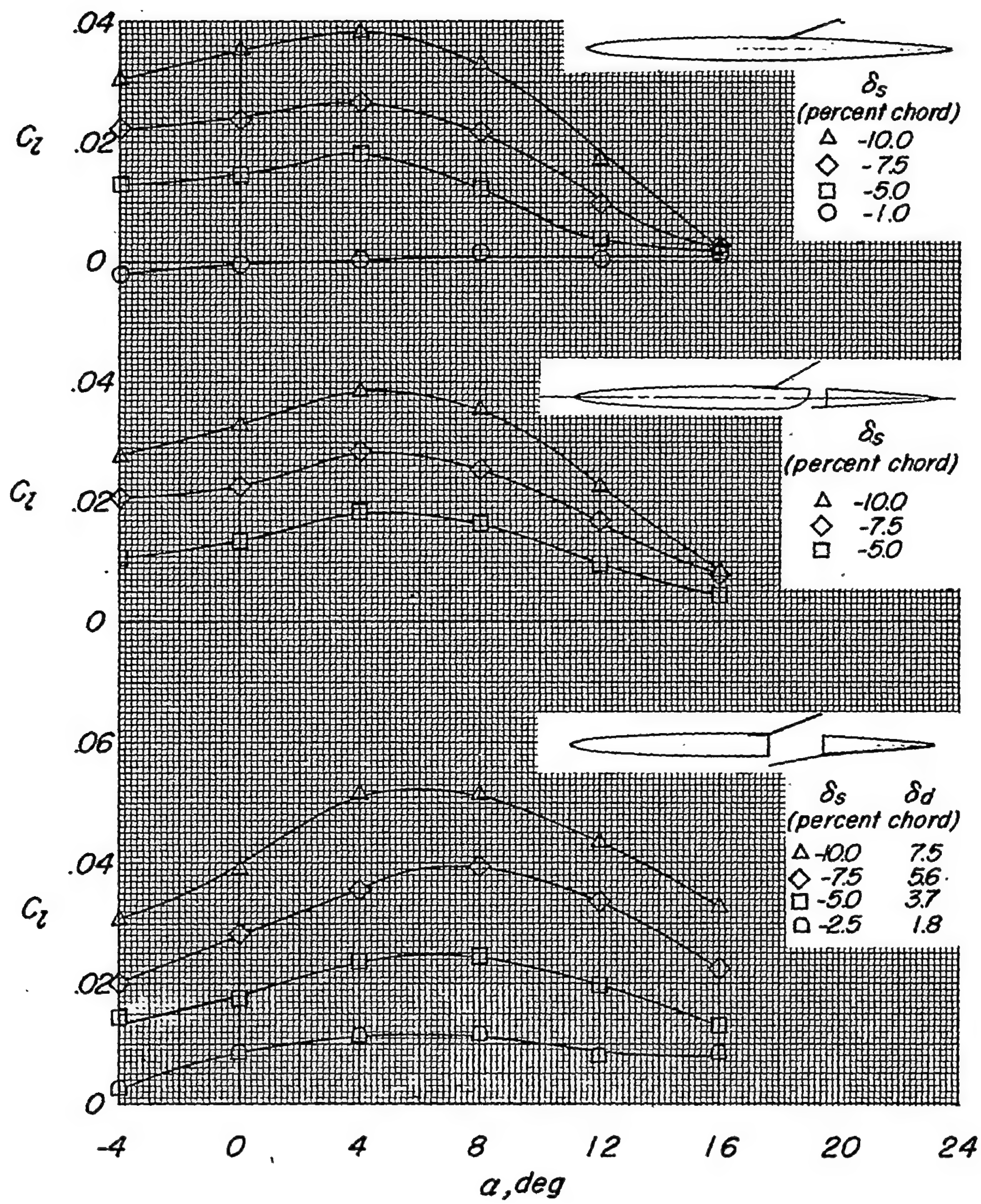


Figure 3.- Aerodynamic characteristics of the plain wing.



(a) M = 0.62.

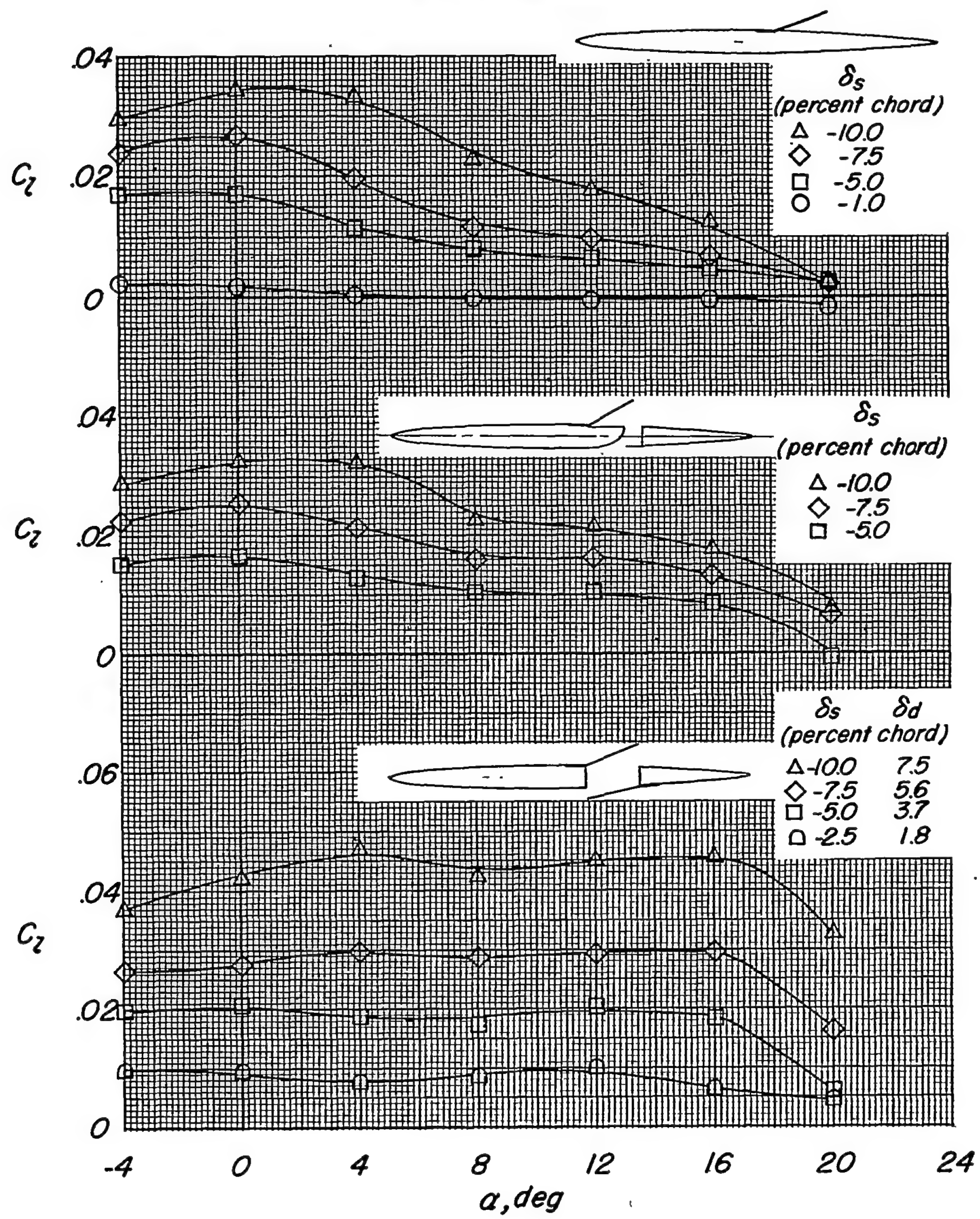
Figure 4.- Rolling-moment characteristics of the spoiler alone, the spoiler-gap-lip combination, and the spoiler-slot-deflector combination.



(b) M = 0.84.

Figure 4.- Continued.

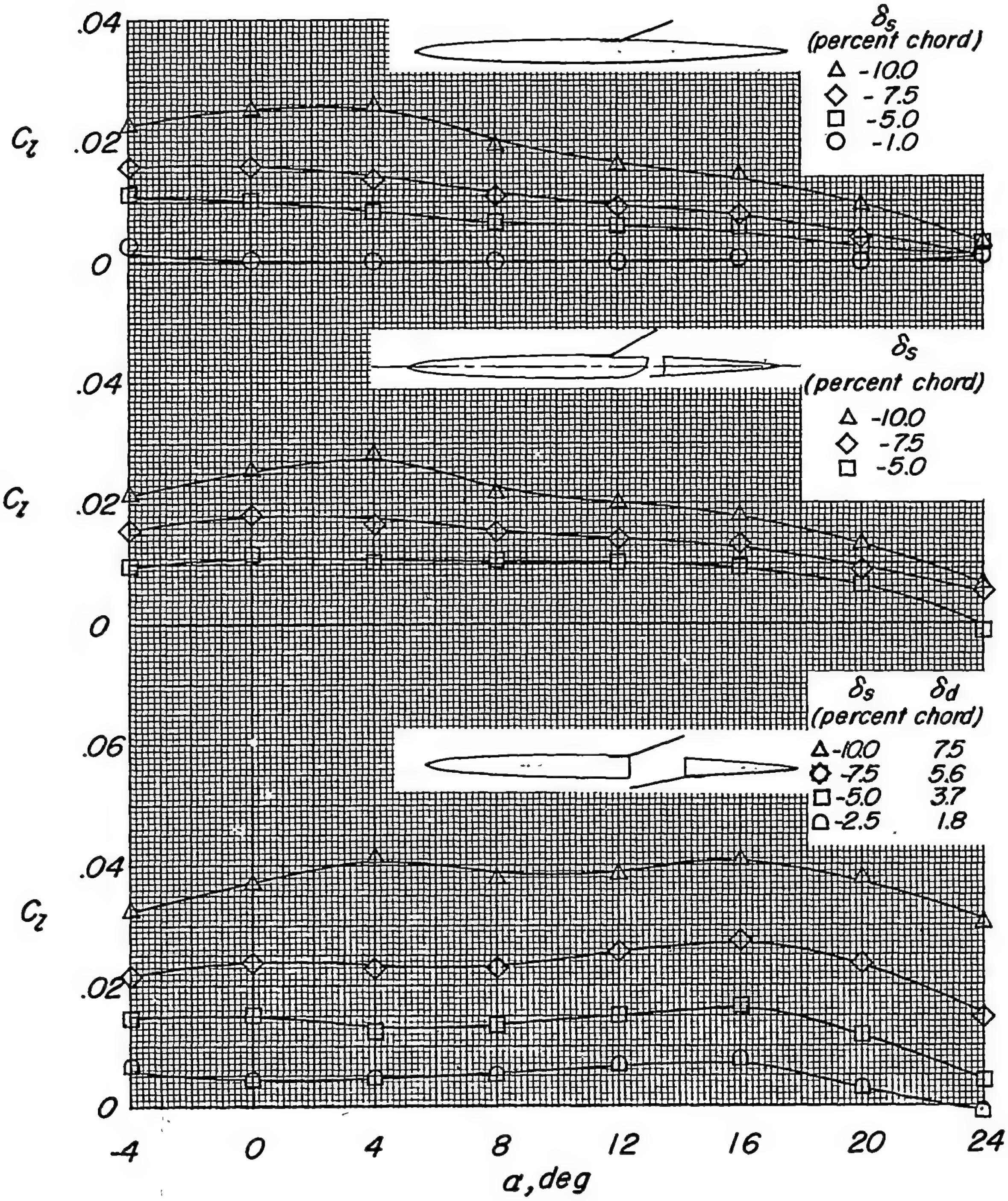
[redacted]



(c) M = 0.95.

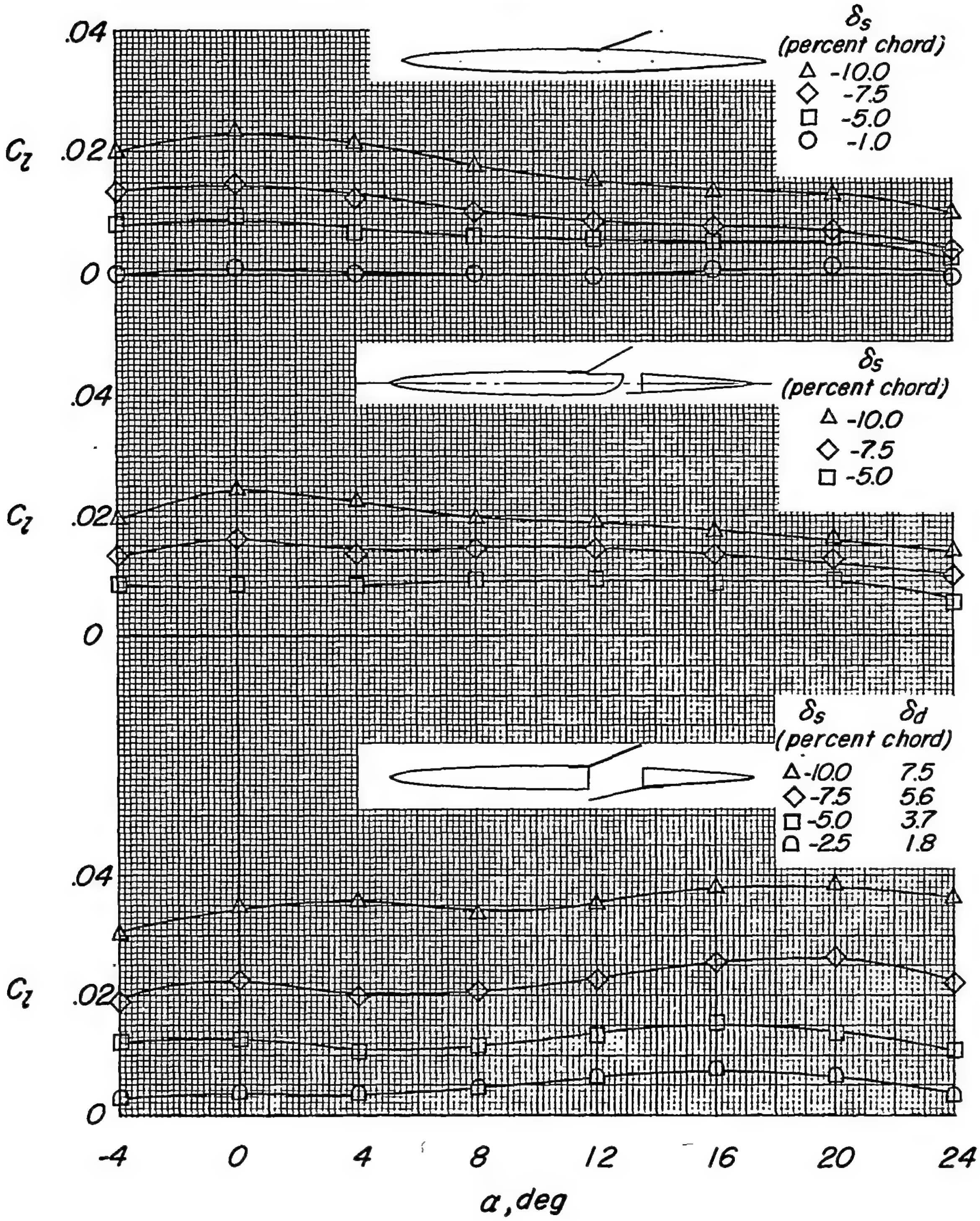
Figure 4.- Continued.

[redacted]



(d) M = 1.01.

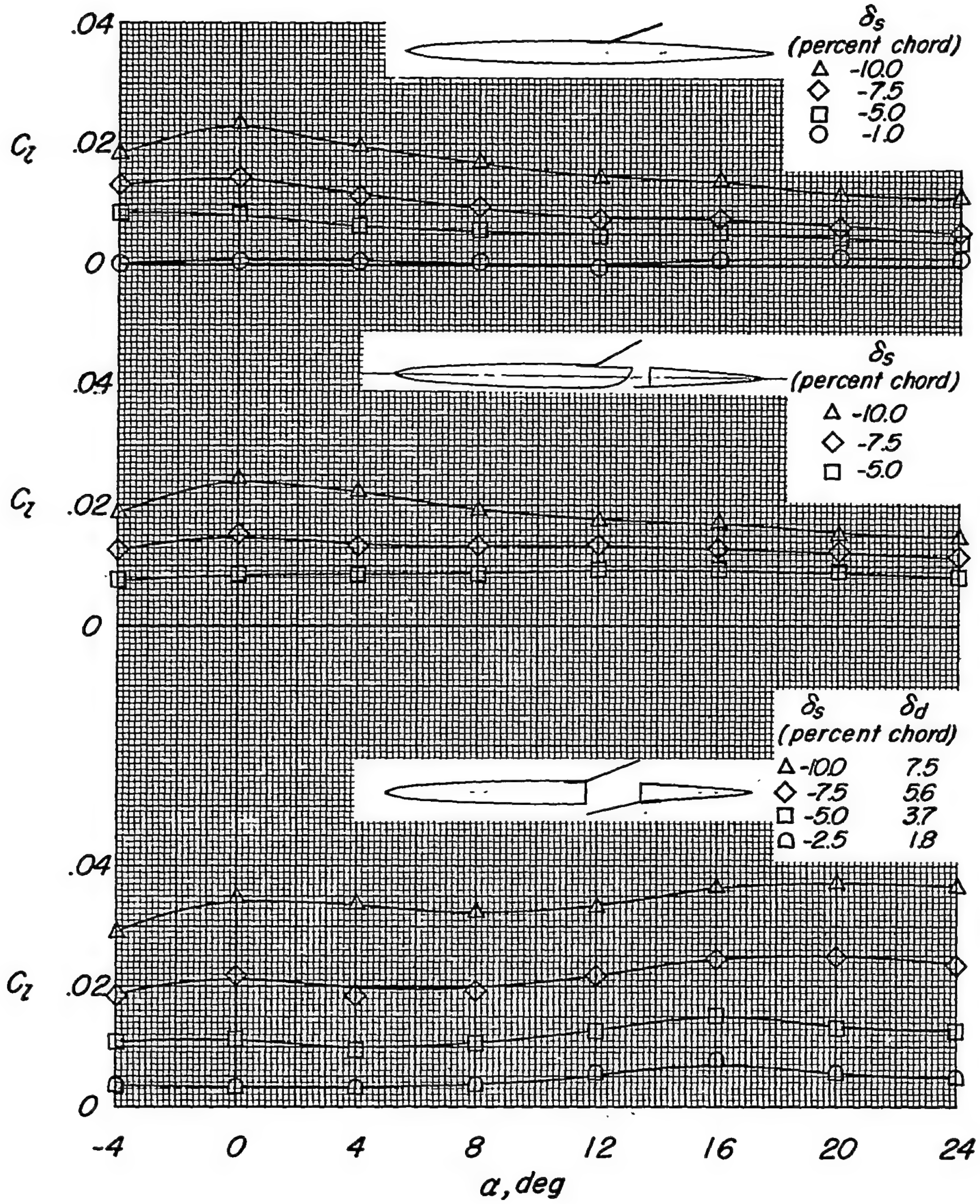
Figure 4.- Continued.



(e) M = 1.07.

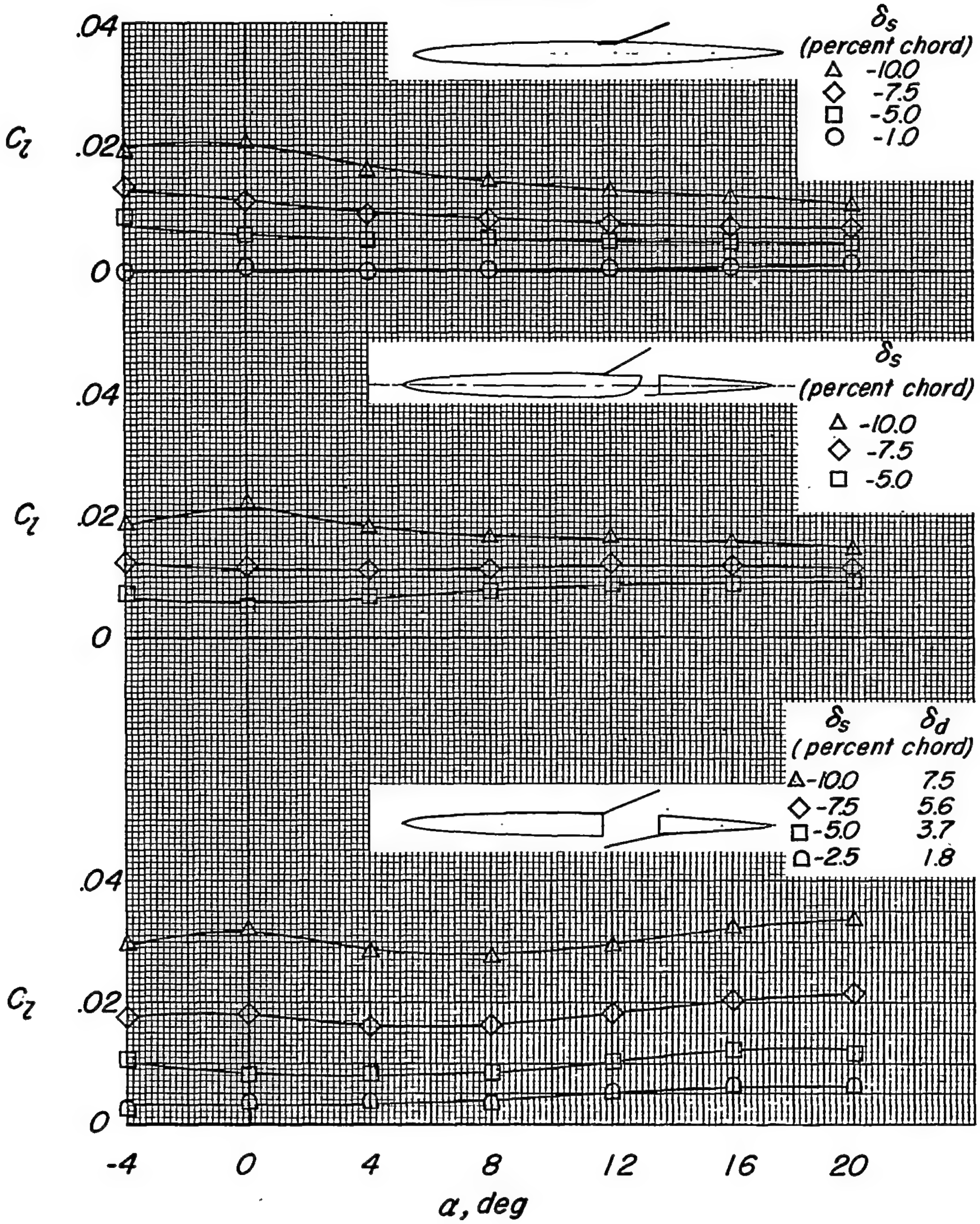
Figure 4.- Continued.

[redacted]



(f) M = 1.12.

Figure 4.- Continued.



(g) M = 1.20.

Figure 4.- Concluded.

[redacted]

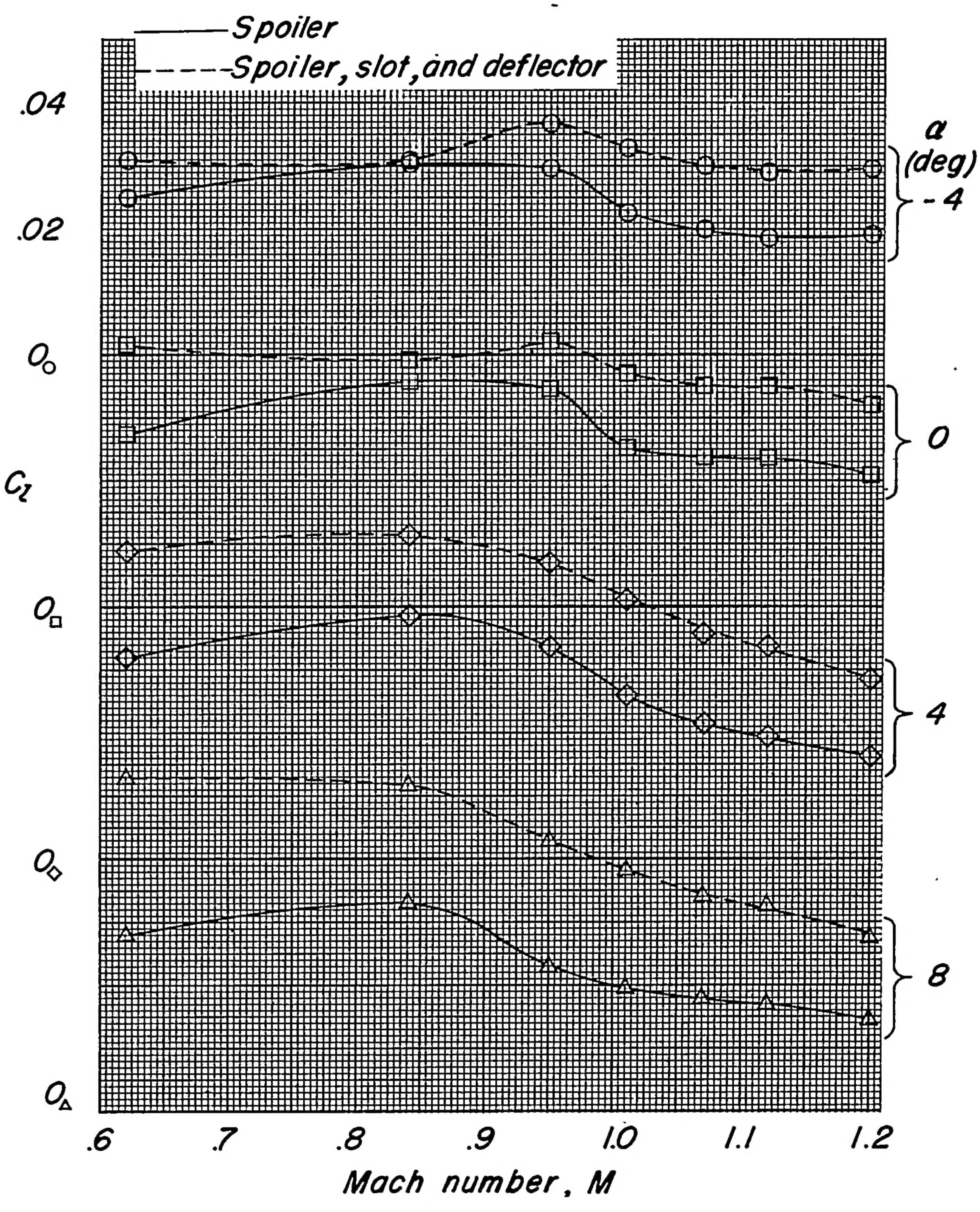


Figure 5.- Variation of rolling-moment coefficient with Mach number at various wing angles of attack for the spoiler alone and the spoiler-slot-deflector combination. $\delta_s = -0.10c$; $\delta_d = 0.075c$.

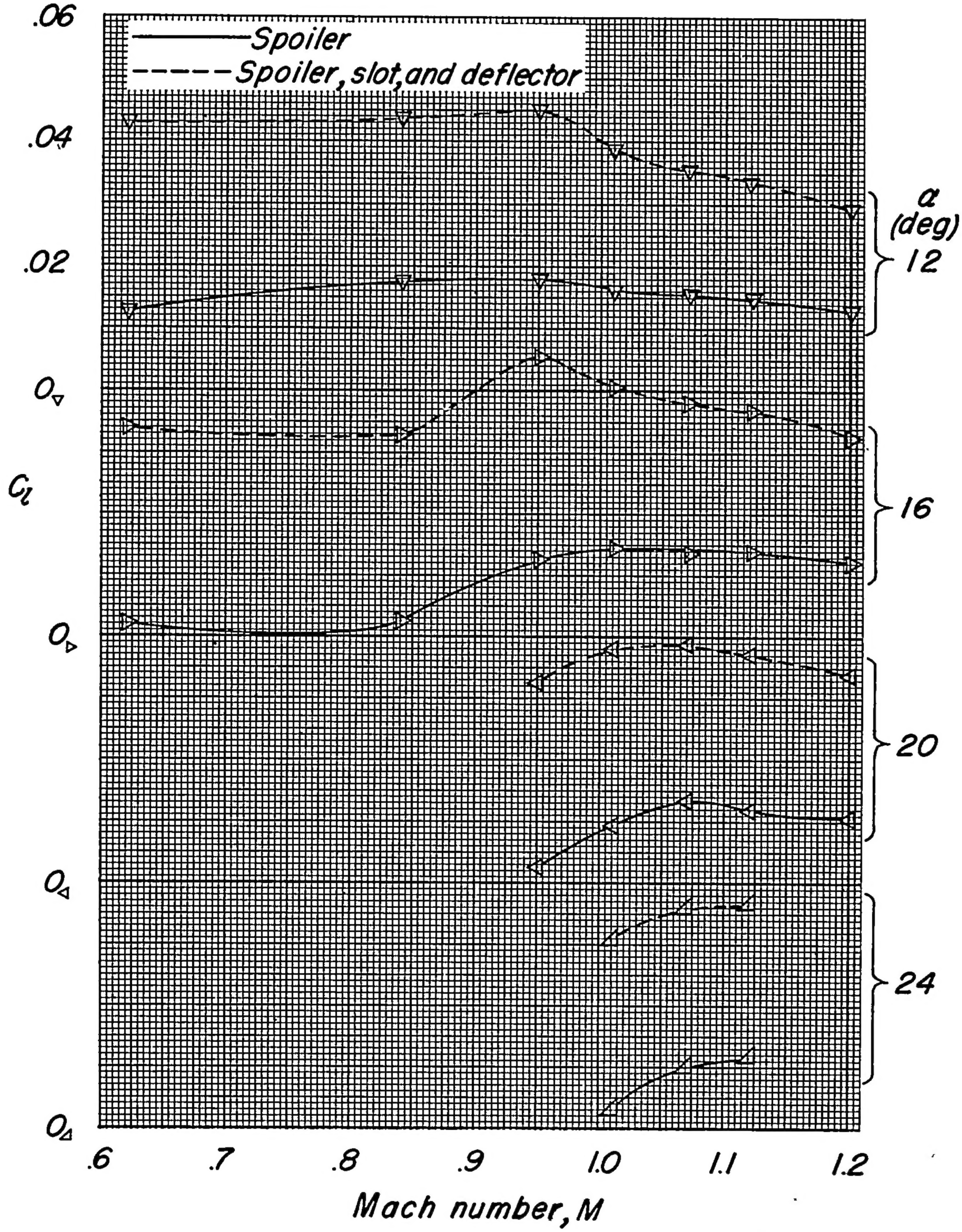


Figure 5.- Concluded.

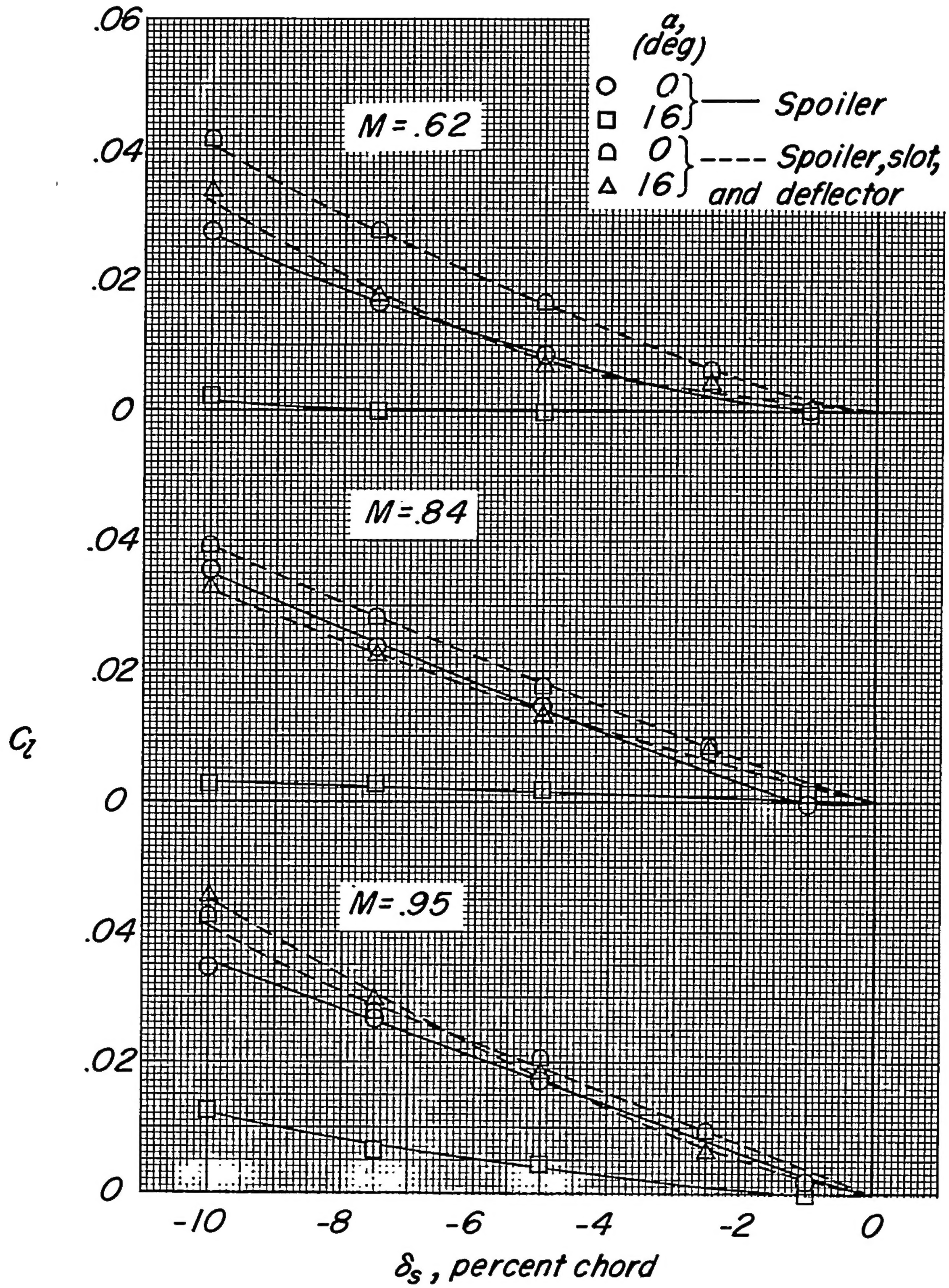


Figure 6.- Variation of rolling-moment coefficient with projections of the spoiler alone and the spoiler-slot-deflector combination. $\delta_d = -0.75\delta_s$.

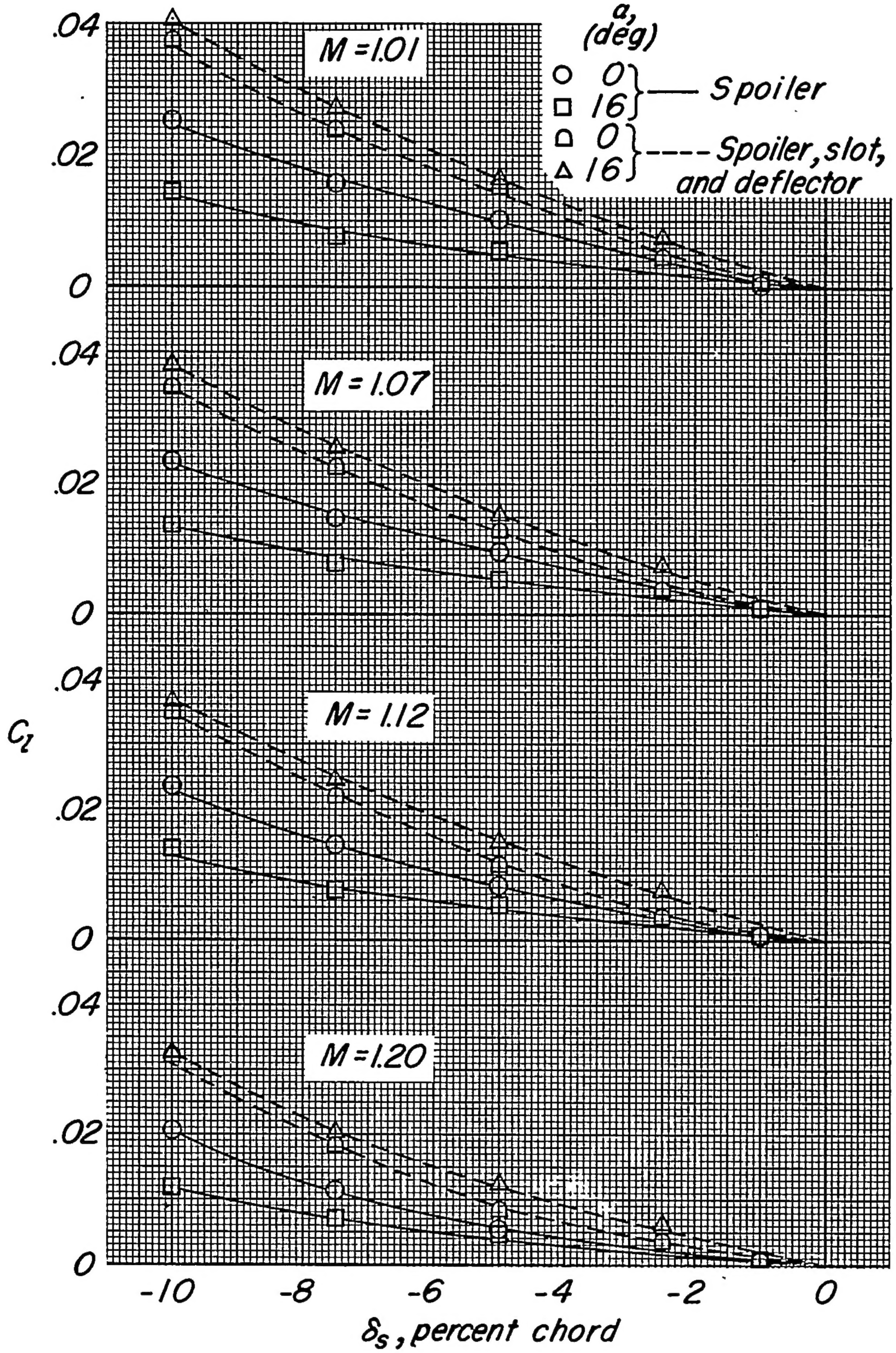


Figure 6.- Concluded.